Modification	At what stage is this document in the process?
DCRP/GC0106/Report to Authority Implementation of the EU NC System Operation Guidelines	01 Modification 02 DCRP report 03 Public Consultation 04 Final Modification Report

The purpose of this document is to assist the Authority in its decision to implement the proposed modifications to the Distribution Code, Engineering Recommendation G83 and G98. The proposed modification deals with the consequential changes to the above documents to ensure compliance with EU Law.

Date of publication: 24 December 2018

Recommendation

The DNOs recommend that the proposed modifications are made to Engineering Recommendations G83, G98 and the Distribution Code.

	The Proposer recommends that this modification should be: Submitted to the Authority for approval
	High Impact: None
	Medium Impact: None
	Low Impact: Installers of Type A power generating modules of less than 16A per phase.

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- **Appendix 1 - Responses**
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- **Appendix 3 – Proposed G83 Modifications**
- **Appendix 4 – Proposed G98 Modifications**

Timetable

WG Consultation Closed	27 April 2018
Final proposals presented to DCRP	06 December 2018
Final Modification Report submitted to Authority	24 December 2018

Any questions?

Contact:
Mark Dunk

dcode@energynetworks.org

020 7706 5174

Proposer: **Distribution Network Licensees**

Purpose of the Modification

The implementation of the EU Network Codes is creating a substantial amount of modifications to the GB documentation. Following scrutiny of Regulation (EU) 2017/1485 "Systems Operations Guidelines", or SOGL, by a joint DCRP/GCRP working group, the modification details proposed in this report, together with those proposed as GC0106 by National Grid, will ensure compliance with the SOGL by the deadline date of 14 March 2019.

Details of the Proposal

What

Data exchange provisions that already exist in the Grid and Distribution Codes were reviewed to ensure that they are in line with the data exchange requirements the SOGL. The proposed changes that are necessary for compliance of the SOGL include submission of updated Grid Code DRC Schedule 5 data from DNOs to National Grid in week 50 and submission of sub 1 MW embedded generation, aggregated by energy source, by DNOs in week 24.

ENTSO-E has also published the Key Organizational Requirements, Roles and Responsibilities (KORRR) under Article 40 of the SOGL. This has also been reviewed to determine its impact on the Grid and Distribution Codes.

The draft amendments to the Distribution Code attached as Appendix 2 do not include the text changes of DCRPMP/18/02 submitted on 20 December, ie the change in the Distribution Code of NGC into NGESO or NGET as appropriate. Assuming the Authority approve DCRPMP/18/02 that will then be version 36 of the Distribution Code, and if the modification of this report (ie DCRP/GC0106) is then approved the amendments of Appendix 2 will be added to version 37, ie creating version 38.

Why

Guidance from BEIS and Ofgem was to apply the new EU requirements within the existing GB regulatory frameworks and to use the existing governance processes. This would provide accessibility and familiarity to GB parties, as well as putting in place a robust governance route to apply the new requirements in a transparent and proportionate way.

The SOGL entered into force (EIF) on 14 September 2017 and as such all countries of the European Union are required to comply with it. Within this regulation there is a section concerned with data exchange requirements (Articles 40-53) which is the scope of this modification proposal. These articles have a specific deadline for implementation, namely 18 months after the SOGL EIF, ie by 14 March 2019. This is the latest date for implementation of this modification.

How

In line with Ofgem advice, this modification will make only those changes necessary to the relevant industry documents to ensure compliance with the European codes and guidelines. In the case of GC0106, only the necessary changes to existing data exchange provisions in the Grid and Distribution Codes will be made to ensure GB is compliant with the requirements detailed in SOGL

When

The Data Exchange section of SOGL has a specific timeline meaning that it has to apply 18 months after entry into force of the SOGL, so by 14 March 2019. However there is no reason to wait until 14 March before enacting the proposed changes. An implementation date of 14 February is proposed.

This Report is being submitted to the Authority at the same time as National Grid submit the GCRP GC0106 Report. Hence Ofgem will have the benefit reviewing the two submissions at the same time.

Workgroup Discussions and Consultation

The joint GCRP/DCRP GC0106 work group identified specific changes necessary to the Grid and Distribution Codes. They are highlighted as follows:

- Amend the submission process of standing or 'structural' network data from an annual process to a 6 monthly cycle (SOGL Article 43, paragraph 4) – this has no implications for the Distribution Code.
- Include the total aggregated generating capacity for all Embedded Power Stations less than 1MW split per primary energy source (SOGL Article 43, paragraph 5) – this has implications for EREC G83 and EREC G98 (ie for new small installations of less than 16 amp per phase). EREC 59 and EREC 99 are already compliant with the requirements of SOGL 43.5
- Update EREC G83 (page 27 and 28 of Appendix 2) and EREC G98 to include capturing all the necessary prime movers/energy sources that the DNOs need to report.
- Update the Distribution Code with a paragraph giving Users the right to request data from the DNO – this will ensure compliance with KORRR Article 5.
- No other changes are proposed at this time, ie in every other respect the status quo in GB is compatible with the flexible requirements of the SOGL and any future changes will need to be progressed through normal GB governance arrangements.

The work group consulted on the proposed changes to the Grid and Distribution Codes from 06 April to 27 April 2018. Eight responses were received, and these are included in Appendix 1.

There was very little comment on the proposed changes to the Distribution Code documents. The bulk of the comments related to Grid Code issues.

Subsequently the focus of the working group was the Workgroup Alternative Grid Code Modifications (WAGCMs) raised under Grid Code governance. The working group retained its Distribution Code overview, but the outcome of the WAGCM discussions had no new implications for the Distribution Code documents.

There were two minor amendments to the Distribution Code documents legal text suggest by UKPN (see Appendix 1). One amendment is a minor change to the wording of the new DPC 8.3.2, and also to add storage as a primary energy source to the G83 and G98 modifications (which avoids owners of storage equipment using the "other" category). These have been incorporated in the final versions submitted here.

Impacts on Total System and the DNOs' Systems

There is no impact on the Total System nor on DNOs' systems

.

Impacts on the Users of DNOs' Systems

New owners/installers of domestic scale generation under EREC G83 (until 26 April 2019) and EREC G98 will have to indicate the energy source of the generation as part of their submission of information to DNOs.

Assessment against Distribution Code Objectives

(i) To permit the development, maintenance and operation of an efficient, coordinated and economical system for the distribution of electricity;

The proposal has a neutral impact on this objective.

(ii) To facilitate competition in the generation and supply of electricity

The proposal has a neutral impact on this objective.

(iii) Efficiently discharge the obligations imposed upon DNOs by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators.

The proposal has a positive impact on this objective.

(iv) Promote efficiency in the implementation and administration of the Distribution Code.

The proposal has a neutral impact on this objective.

Impact on other Industry documents

There are no impacts on other industry documents (excepting the parallel changes to the Grid Code).

Environmental Impact Assessment

There are no environmental impacts associated with this proposed modification.

Distribution Code Review Panel Recommendation

The responses to the consultation were discussed at the DCRP meeting on 6 December 2018 and the Panel agreed that the changes should be submitted to Ofgem.

Recommendation

The Licenced Distribution Network Operators and the DCRP recommend that this modification report should;

- be submitted to the Authority for approval; and
- subject to the agreement of the Authority the modification should be implemented from the date the revised Distribution Code is published. This date is recommended to be 14 February 2019, or such other date as the Authority directs.

Appendices

Appendix 1	Responses to the consultation
Appendix 2	Proposed amendment to the Distribution Code
Appendix 3	Proposed revision to EREC G83
Appendix 4	Proposed revision to EREC G98

Grid Code Workgroup Consultation Response Proforma

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL)

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **5pm** on **27 April 2018** to grid.code@nationalgrid.com. Please note that any responses received after the deadline or sent to a different email address may not receive due consideration by the Workgroup.

Any queries on the content of the consultation should be addressed to Chrissie Brown at Christine.brown1@nationalgrid.com

Respondent:	*Alan Creighton*
Company Name:	*Northern Powergrid*
Please express your views regarding the Workgroup Consultation, including rationale. **(Please include any issues, suggestions or queries)**	*For reference, the Grid Code objectives are:* i. To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity ii. To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity) iii. Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole iv. To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and v. To promote efficiency in the implementation and administration of the Grid Code arrangements. *The Distribution Code objectives are:* i. Permit the development, maintenance, and operation of an efficient, coordinated and economical System for the distribution of electricity. ii. Facilitate competition in the generation and supply of electricity. iii. Efficiently discharge the obligations imposed upon DNOs

	by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators. iv. Promote efficiency in the implementation and administration of the Distribution Code.

Standard Workgroup Consultation questions

Q	Question	Response
1	Do you believe that GC0106 Original proposal, or any potential alternatives for change that you wish to suggest, better facilitates the Grid Code Objectives?	Yes
2	Do you support the proposed implementation approach?	Yes
3	Do you have any other comments?	It would be helpful if, following the completion of this Modification Proposal, NGET were to review the DG data requested from DNOs in Schedule 11 (per GSP), Schedule 11 (GC0042 DG >1MV) and the new information forming this GC0106 proposal. The purpose of such a review would be to clarify the information that NGET require and to ensure consistency between the three data submissions. Harmonisation would help DNOs to structure their generation databases and provide consistency in reporting e.g. how to treat a Small Power Station >1MW with multiple energy sources such as PV and Battery.
4	Do you wish to raise a WG Consultation Alternative Request for the Workgroup to consider?	No

Specific GC0106 questions

Q	Question	Response

5	For those respondents that the Workgroup believes are directly affected by the GC0106 proposal (i.e. (i) new Type A power generating modules of less than 16A per phase, (ii) DNOs and (iii) CDSOs) do you agree with the proposed revised data exchange requirements? Do you have any comments on the drafting of the associated legal text set out in Annexes 4, 6 and 7?	**Comments on Annex 4 – Grid Code text** 1 The proposed new text in PC. A 1.2 (a) (i) should be supplemented with the additional words underlined: In addition the structural data in DRC Schedule 5 provided by calendar week 28 shall be updated and provided by Network Operators in week 50 of each year (again which may be delayed as above until week 2 of the following calendar year) Schedule 5 (page 10 of 10), in part (c) of the Short Circuit Analysis section requires that demand and short circuit data is provided in a DNO week 24 schedule 5 submission. The DNO week 24 Schedule 5 templates include fault level and demand data. We understand that the intent of the DCC Art 43-3 is that the DNO only needs to provide an update of the structural data; the purpose of the additional words above is to clarify this intent. However given that 'structural data' is not a defined Grid Code term, this might not be sufficiently clear and it may be necessary to : a) Define structural data; b) Include the list of structural data items from Art 43 in the text above; or c) Draft the text to refer explicitly to the parts of the GCode that require the individual components of the Schedule 5 data e.g. line data, transformer data etc. 2 The proposed new text in PCA 3.1.4. (iii) should be replaced with : (iii) beginning from the 2019 Week 24 data submission, for **Embedded Power Stations** with **Registered Capacity** of 1MW or less, their best estimate of the aggregated capacity of all such **Embedded Power Stations** per production type as defined the list in PC.A.3.1.4 (a)(ii)(2)(a). The above text clarifies the requirement and also that the DNOs are required to provide their best estimates of the aggregated capacity in accordance with DCC Article 43 - 5. 3 The proposed new Schedule 11 should be

		included in the proposed changes to the Grid Code. Our understanding is that the proposal is as per the schedule below. The proposed reference to 'Network Operator Unique Reference Number' should be deleted. We assume that this has been carried over from the current Schedule 11 GC0042 table, but doesn't have a meaning for aggregated generation capacities.
6	Do you believe that the solution described in this Workgroup Report discharges the legal obligations of the SOGL and other relevant EU legislation?	Yes
7	For those parties that the Workgroup believes are not directly affected by the GC0106 proposed revised data exchange requirements, do you have any comments on the approach and/or legal drafting?	N/A
8	Do you have any views on the legal interpretation aspects set out in Section 9 together with the explanatory information in Annexes 2 and 3?	We believe that the interpretation provide and used to form this Modification is reasonable.
	Legal text comments	
	If you believe there are issues in the legal text, can you please bring these to our attention by using the space provided here. These will then be discussed at the GC0106 Workgroup meetings planned following the closure of this Consultation.	Please see our response to Question 5 above.

Schedule 11 Embedded Small Power Stations <1MW

Date	
Network Operator	
Network Operator Unique Ref. No.	

Fuel Type	**Aggregate Registered Capacity** Total MW	**Number of PGMs**	**Comments**
Biomass			
Fossil brown coal/lignite			
Fossil coal-derived gas			
Fossil gas			
Fossil hard coal			
Fossil oil			
Fossil oil shale			
Fossil peat			
Geothermal			
Hydro pumped storage			
Hydro run-of-river and poundage			
Hydro water reservoir			
Marine			
Nuclear			
Other renewable			
Solar			
Waste			
Wind offshore			
Wind onshore			
Other			

Grid Code Workgroup Consultation Response Proforma

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL)

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **5pm** on **27 April 2018** to grid.code@nationalgrid.com. Please note that any responses received after the deadline or sent to a different email address may not receive due consideration by the Workgroup.

Any queries on the content of the consultation should be addressed to Chrissie Brown at Christine.brown1@nationalgrid.com

Respondent:	*Graeme Vincent; graeme.vincent@spenergynetworks.co.uk*
Company Name:	*SP Energy Networks*
Please express your views regarding the Workgroup Consultation, including rationale. **(Please include any issues, suggestions or queries)**	*For reference, the Grid Code objectives are:* i. To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity ii. To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity) iii. Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole iv. To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and v. To promote efficiency in the implementation and administration of the Grid Code arrangements. *The Distribution Code objectives are:* i. Permit the development, maintenance, and operation of an efficient, coordinated and economical System for the distribution of electricity. ii. Facilitate competition in the generation and supply of electricity. iii. Efficiently discharge the obligations imposed upon DNOs

	by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators. iv. Promote efficiency in the implementation and administration of the Distribution Code.

Standard Workgroup Consultation questions

Q	Question	Response
1	Do you believe that GC0106 Original proposal, or any potential alternatives for change that you wish to suggest, better facilitates the Grid Code Objectives?	Yes, as the proposal implements the requirements of the EU System Operations Guideline in relation to the data exchange articles.
2	Do you support the proposed implementation approach?	Yes
3	Do you have any other comments?	No
4	Do you wish to raise a WG Consultation Alternative Request for the Workgroup to consider?	No

Specific GC0106 questions

Q	Question	Response
5	For those respondents that the Workgroup believes are directly affected by the GC0106 proposal (i.e. (i) new Type A power generating modules of less than 16A per phase, (ii) DNOs and (iii) CDSOs) do you agree with the proposed revised data exchange requirements? Do you have any comments on the drafting of the associated legal text set out in Annexes 4, 6 and 7?	We agree with the revision to data requirements
6	Do you believe that the solution described in this Workgroup Report discharges the legal	Yes – we believe that the proposal discharges the SOGL data obligations.

	obligations of the SOGL and other relevant EU legislation?	
7	For those parties that the Workgroup believes are not directly affected by the GC0106 proposed revised data exchange requirements, do you have any comments on the approach and/or legal drafting?	No response
8	Do you have any views on the legal interpretation aspects set out in Section 9 together with the explanatory information in Annexes 2 and 3?	Whilst we acknowledge the views being expressed in Annex2, we believe that based on the evidence and our reading of the relevant sections that the interpretation within Annex 3 to be correct.
	Legal text comments	
	If you believe there are issues in the legal text, can you please bring these to our attention by using the space provided here. These will then be discussed at the GC0106 Workgroup meetings planned following the closure of this Consultation.	In PC.A.3.1.4 (a)(iii) should small be capitalised ie Embedded Small Power Station

Grid Code Workgroup Consultation Response Proforma

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL)

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **5pm** on **27 April 2018** to grid.code@nationalgrid.com. Please note that any responses received after the deadline or sent to a different email address may not receive due consideration by the Workgroup.

Any queries on the content of the consultation should be addressed to Chrissie Brown at Christine.brown1@nationalgrid.com

Respondent:	Alastair Frew
Company Name:	ScottishPower Generation Ltd
Please express your views regarding the Workgroup Consultation, including rationale. **(Please include any issues, suggestions or queries)**	*For reference, the Grid Code objectives are:* i. To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity ii. To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity) iii. Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole iv. To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and v. To promote efficiency in the implementation and administration of the Grid Code arrangements. *The Distribution Code objectives are:* i. Permit the development, maintenance, and operation of an efficient, coordinated and economical System for the distribution of electricity. ii. Facilitate competition in the generation and supply of electricity. iii. Efficiently discharge the obligations imposed upon DNOs

	by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators. iv. Promote efficiency in the implementation and administration of the Distribution Code.

Standard Workgroup Consultation questions

Q	Question	Response
1	Do you believe that GC0106 Original proposal, or any potential alternatives for change that you wish to suggest, better facilitates the Grid Code Objectives?	Yes
2	Do you support the proposed implementation approach?	Yes
3	Do you have any other comments?	No
4	Do you wish to raise a WG Consultation Alternative Request for the Workgroup to consider?	No

Specific GC0106 questions

Q	Question	Response
5	For those respondents that the Workgroup believes are directly affected by the GC0106 proposal (i.e. (i) new Type A power generating modules of less than 16A per phase, (ii) DNOs and (iii) CDSOs) do you agree with the proposed revised data exchange requirements? Do you have any comments on the drafting of the associated legal text set out in Annexes 4, 6 and 7?	N/A
6	Do you believe that the solution described in this Workgroup Report discharges the legal	Yes

	obligations of the SOGL and other relevant EU legislation?	
7	For those parties that the Workgroup believes are not directly affected by the GC0106 proposed revised data exchange requirements, do you have any comments on the approach and/or legal drafting?	No
8	Do you have any views on the legal interpretation aspects set out in Section 9 together with the explanatory information in Annexes 2 and 3?	It is difficult to see with the actual words used which interpretation is actually correct.
	Legal text comments	
	If you believe there are issues in the legal text, can you please bring these to our attention by using the space provided here. These will then be discussed at the GC0106 Workgroup meetings planned following the closure of this Consultation.	No

Grid Code Workgroup Consultation Response Proforma

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL)

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **5pm** on **27 April 2018** to grid.code@nationalgrid.com. Please note that any responses received after the deadline or sent to a different email address may not receive due consideration by the Workgroup.

Any queries on the content of the consultation should be addressed to Chrissie Brown at Christine.brown1@nationalgrid.com

Respondent:	*Damian Jackman, 07789 551669, Damian.jackman@sse.com*
Company Name:	*SSE Generation Ltd*
Please express your views regarding the Workgroup Consultation, including rationale. **(Please include any issues, suggestions or queries)**	We do not believe that the solution described in the report discharges the legal obligations in regard to real-time data from Type B, C and D generators. We acknowledge that the TSO has taken legal guidance on the degree of flexibility it believes it is afforded in deciding whether to impose real-time data gathering requirements but we would like to highlight the broader context of the System Operator Guidelines within the context of the current GB balancing costs: • The over-arching aims of the 3rd Energy Package were: 1. The secure operation of European power systems 2. The integration of large volumes of low carbon generation 3. The creation of a single European electricity market • In parallel with these aims, one of the top government priorities is to reduce costs for the consumer, particularly in light of the rising costs being levied on consumer's bills associated with low-carbon generation. • The proposal in this consultation is to continue with the status-quo with regards to real time data provision as "*..going beyond the status quo will lead to high financial investment with little benefit to the TSO*" (P.13) • However, this statement of opinion by the TSO is not supported by a cost benefit analysis but yet it has been used to justify the proposed solution of 'minimum change'. • In summary, it would seem the TSO has started from a position of 'minimum change' (without cost benefit justification) and then looked for any possible way to justify this position legally, without consideration of the

	broader context of the 3rd Energy Package or prospect of lower bills for the consumer by having a more efficient system with lower balancing costs . • Given this context we do not feel the proposed solution - insofar as it does not require real-time data exchange from generators in the Type B and Type C bands – fully supports the Grid Code objectives in that it will lead to higher BSUoS costs due to lack of visibility the TSO will have over embedded generation than could otherwise been the case had real-time data been required from all generator types within bands B & C.

Standard Workgroup Consultation questions

Q	Question	Response
1	Do you believe that GC0106 Original proposal, or any potential alternatives for change that you wish to suggest, better facilitates the Grid Code Objectives?	Yes
2	Do you support the proposed implementation approach?	
3	Do you have any other comments?	
4	Do you wish to raise a WG Consultation Alternative Request for the Workgroup to consider?	*If yes, please complete a WG Consultation Alternative Request form, available on National Grid's website, https://www.nationalgrid.com/uk/electricity/codes/grid-code and return to the Grid Code inbox at grid.code@nationalgrid.com*

Specific GC0106 questions

Q	Question	Response
5	For those respondents that the Workgroup believes are directly affected by the GC0106 proposal (i.e. (i) new Type A power generating modules of less than 16A per phase, (ii) DNOs and (iii) CDSOs) do you agree with the proposed revised data exchange requirements? Do you have any comments on the drafting of the	Yes – we support the proposal for Type A generators

	associated legal text set out in Annexes 4, 6 and 7?	
6	Do you believe that the solution described in this Workgroup Report discharges the legal obligations of the SOGL and other relevant EU legislation?	No.
7	For those parties that the Workgroup believes are not directly affected by the GC0106 proposed revised data exchange requirements, do you have any comments on the approach and/or legal drafting?	• Not imposing common requirements on all generator Types runs against the broad vision of the 3rd Energy Package to create *harmonised* technical requirements for generators of similar capacity. • Instead, the proposed solution continues to impose extra costs on older generators in some parts of the country (e.g. Scotland) by requiring them to continue to provide real time data to the TSO, whereas generators in other parts of the country (England and Wales) continue to be exempt from real time data exchange. • The continued growth of small scale embedded generators powered by 'renewable' sources, (whose capacities will typically in the Type B and C bands where there this geographic discrimination occurs), the TSO will increasingly struggle to accurately determine generation output based purely on weather forecasts and forecast the despatch required to balance the system. • This uncertainty in forecasting output will lead to more balancing actions and will continue to push up BSUoS costs in the longer term. • If the TSO had real-time data from all Type B and C generators as is permitted by the SOGL, then it would have far higher certainty in forecasting generation output and therefore would be able to plan further ahead and take more cost-effective system actions to balance the system and manage constraints. • Lower balancing costs will feed through to lower costs for consumers by reducing wholesale energy costs. • We accept that imposing consistent requirements of real-time data submission on *all* existing and new generators - irrespective of their location within GB – may in some cases incur a cost for some generators to

		install associated communications equipment – mainly those embedded generators in in England and Wales - who do not currently provide this data, as well as a cost to the DNOs and TSO to integrate their communications. However this one-off cost would over time lead to lower costs for generators and consumers in the form of lower BSUoS costs from fewer balancing actions needing to be taken than would otherwise have been the case. • It should be noted in this context that National Grid have historically underestimated the growth in capacity of embedded generation (mainly Type B and Type C generators) For example in the 2012 Ten Year Statement National Grid forecasted 11 GW of embedded generation by 2017 when the actual amount proved to be ~26 GW. In the same year it was also forecasting ~17 GW of embedded generation by 2030 when the most recent forecasts of 2017 is now around 40 GW – likely in excess of true demand and will require significant balancing actions to manage. • The TSO should perform a cost-benefit analysis to show why it is **not** cost-effective to gather real time data from all generators in the Type B and Type C bands (existing and future) given the potential for large annual cost savings in future balancing actions.
8	Do you have any views on the legal interpretation aspects set out in Section 9 together with the explanatory information in Annexes 2 and 3?	We agree with the concern raised by a Workgroup Member that the Proposers' solution to dealing with the 'the TSO provides' issue is legally incorrect and that the consequences of this, for the Proposer, are minimal as these consequences (of non compliance with the SOGL related data exchange requirements) fall upon DNOs and SGUs (and not the TSOs).
	Legal text comments	
	If you believe there are issues in the legal text, can you please bring these to our attention by using the space provided here. These will then be discussed at the GC0106 Workgroup meetings planned following the closure of this Consultation.	

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Company:
UK Power Networks
(Operations) Limited

Chrissie Brown
National Grid
1-3 Strand
WC2N 5EH
LONDON

By electronic copy only to: grid.code@nationalgrid.com

27 April 2018

Dear Chrissie

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL) – UK Power Networks response

Thank you for the opportunity to respond to the above consultation. Our response should be treated as consolidated on behalf of UK Power Networks' three distribution licence holding companies: Eastern Power Networks plc, London Power Networks plc, and South Eastern Power Networks plc.

We acknowledge that the modification proposal has been recommended in order to implement changes found in the System Operator Guidelines (SOGL) Code. We have reviewed the consultation and supporting documentation and provide the following feedback with respect to the proposed changes to the Grid Code regarding structural data submissions from Distribution Network Operators (DNOs):

- In the absence of further guidance or consultation documents that may yet be presented, we have no alternative proposal to make.

- We do not object to the proposed implementation approach and legal text in the Grid Code PC.A.1.2 (iii). However, we do require additional information in the form of guidance on how updated Schedule 5 data will be required – in particular with respect to load assumptions and/or considerations for plant commissioned between submissions. This will allow us to understand the changes to and business impacts on our current processes required to produce the Week 24 submissions.

  Please could you outline how you envision the current guideline document to change and how you will consult with DNO stakeholders on this.

- We wish to raise the following points with respect to the proposed changes to PC.A.3.1.4, relating to the provision of information on embedded small power stations with a registered capacity below 1MW.

    - Although we agree with the proposed changes to EREC G83 and EREC G98 in order to facilitate DNOs obtaining the data required by the National Grid ETSO, EREC G83 states

that: "*The installer is to ensure that the DNO is made aware of the Small Scale Embedded Generators installation at or before the time of commissioning*" [1]

- We therefore rely on the information provided by customers (or their installers) and until the proposed changes in EREC G83 and EREC G98 are implemented, customers will still use the valid Appendix forms (found on either Appendix 3 on EREC G83 of Form B on ERECG98) to inform DNOs of their installation. The information provided might not have all the information as required by the National Grid.

- As such, it is important to clarify that UK Power Networks will use reasonable endeavours to supply the information requested beginning from the 2019 Week 24 submission, but it may nonetheless be the case that the required information from the plant may be missing. The legal text should clearly recognise such circumstances and not inadvertently risk penalising licensees for not providing information which they have not received.

- Furthermore, we would like to propose that "Electricity Storage" is included in the list of technology types in the EREC G83 and EREC G98 proposed amendments. This would enable DNOs to also gather Electricity Storage data and prevent future modifications if this type of distributed energy resource is to be reported as well.

With regards to the legal text proposed, we would like to put forward the following amendments to the legal wording for PC.A.3.1.4 (iii):

(iii) beginning from the 2019 Week 24 data submission, the aggregated per production types from the list in PC.A.3.1.4 (a)(ii)(2)(a) for all Embedded Small Power Stations of Registered Capacity of 1MW or less advised [under EREC G83] to the Network Operator by the relevant date

In addition we also propose the following amendments to the legal wording for the Distribution Planning and Connection Code:

D.P.C 8.3.2 On request from a User, the DNO will notify the User of all the data submitted by and relating to that User under DPC8 that the DNO is holding and using for Distribution Code purposes.

I hope the above feedback has been constructive. If you have any questions, please do not hesitate to contact Sotiris Georgiopoulos (Sotiris.georgiopoulos@ukpowernetworks.co.uk) in the first instance.

Yours sincerely

James Hope
Head of Regulation & Regulatory Finance
UK Power Networks

Copy Sotiris Georgiopoulos, Head of Smart Grid Development, UK Power Networks
Paul Measday, Regulatory Returns & Compliance Manger

[1] EREC G86 Issue 2. Page 5 – Legal Aspects

Grid Code Workgroup Consultation Response Proforma

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL)

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **5pm** on **27 April 2018** to grid.code@nationalgrid.com. Please note that any responses received after the deadline or sent to a different email address may not receive due consideration by the Workgroup.

Any queries on the content of the consultation should be addressed to Chrissie Brown at Christine.brown1@nationalgrid.com

Respondent:	*Peter Twomey*
Company Name:	*Electricity North West*
Please express your views regarding the Workgroup Consultation, including rationale. **(Please include any issues, suggestions or queries)**	*For reference, the Grid Code objectives are:* i. To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity ii. To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity) iii. Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole iv. To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and v. To promote efficiency in the implementation and administration of the Grid Code arrangements. *The Distribution Code objectives are:* i. Permit the development, maintenance, and operation of an efficient, coordinated and economical System for the distribution of electricity. ii. Facilitate competition in the generation and supply of electricity. iii. Efficiently discharge the obligations imposed upon DNOs

	by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators. iv. Promote efficiency in the implementation and administration of the Distribution Code.

Standard Workgroup Consultation questions

Q	Question	Response
1	Do you believe that GC0106 Original proposal, or any potential alternatives for change that you wish to suggest, better facilitates the Grid Code Objectives?	Yes
2	Do you support the proposed implementation approach?	Yes
3	Do you have any other comments?	No
4	Do you wish to raise a WG Consultation Alternative Request for the Workgroup to consider?	*No*

Specific GC0106 questions

Q	Question	Response
5	For those respondents that the Workgroup believes are directly affected by the GC0106 proposal (i.e. (i) new Type A power generating modules of less than 16A per phase, (ii) DNOs and (iii) CDSOs) do you agree with the proposed revised data exchange requirements? Do you have any comments on the drafting of the associated legal text set out in Annexes 4, 6 and 7?	We agree with the revision to data requirements
6	Do you believe that the solution described in this Workgroup Report discharges the legal	Yes – we believe that the proposal correctly interprets and applies SOGL in relation to data requirements.

	obligations of the SOGL and other relevant EU legislation?	
7	For those parties that the Workgroup believes are not directly affected by the GC0106 proposed revised data exchange requirements, do you have any comments on the approach and/or legal drafting?	No comment
8	Do you have any views on the legal interpretation aspects set out in Section 9 together with the explanatory information in Annexes ~~1~~2 and ~~1~~3?	We believe that the implications suggested in Annex 2 are incorrect. We believe Annex 3 to be a correct interpretation of the SOGL drafting.
	Legal text comments	
	If you believe there are issues in the legal text, can you please bring these to our attention by using the space provided here. These will then be discussed at the GC0106 Workgroup meetings planned following the closure of this Consultation.	

Grid Code Workgroup Consultation Response Proforma

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL)

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **5pm** on **27 April 2018** to grid.code@nationalgrid.com. Please note that any responses received after the deadline or sent to a different email address may not receive due consideration by the Workgroup.

Any queries on the content of the consultation should be addressed to Chrissie Brown at Christine.brown1@nationalgrid.com

Respondent:	*Mike Kay*
Company Name:	*Energy Networks Association*
Please express your views regarding the Workgroup Consultation, including rationale. **(Please include any issues, suggestions or queries)**	*For reference, the Grid Code objectives are:* i. To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity ii. To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity) iii. Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole iv. To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and v. To promote efficiency in the implementation and administration of the Grid Code arrangements. *The Distribution Code objectives are:* i. Permit the development, maintenance, and operation of an efficient, coordinated and economical System for the distribution of electricity. ii. Facilitate competition in the generation and supply of electricity. iii. Efficiently discharge the obligations imposed upon DNOs

	by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators. iv. Promote efficiency in the implementation and administration of the Distribution Code.

Standard Workgroup Consultation questions

Q	Question	Response
1	Do you believe that GC0106 Original proposal, or any potential alternatives for change that you wish to suggest, better facilitates the Grid Code Objectives?	Yes
2	Do you support the proposed implementation approach?	Yes
3	Do you have any other comments?	No
4	Do you wish to raise a WG Consultation Alternative Request for the Workgroup to consider?	*No*

Specific GC0106 questions

Q	Question	Response
5	For those respondents that the Workgroup believes are directly affected by the GC0106 proposal (i.e. (i) new Type A power generating modules of less than 16A per phase, (ii) DNOs and (iii) CDSOs) do you agree with the proposed revised data exchange requirements? Do you have any comments on the drafting of the associated legal text set out in Annexes 4, 6 and 7?	We agree with the revision to data requirements
6	Do you believe that the solution described in this Workgroup Report discharges the legal	Yes – we believe that the proposal correctly interprets and applies SOGL in relation to data requirements.

	obligations of the SOGL and other relevant EU legislation?	
7	For those parties that the Workgroup believes are not directly affected by the GC0106 proposed revised data exchange requirements, do you have any comments on the approach and/or legal drafting?	No comment
8	Do you have any views on the legal interpretation aspects set out in Section 9 together with the explanatory information in Annexes ~~1~~2 and ~~1~~3?	We believe that the implications suggested in Annex 2 are incorrect. We believe Annex 3 to be a correct interpretation of the SOGL drafting.
	Legal text comments	
	If you believe there are issues in the legal text, can you please bring these to our attention by using the space provided here. These will then be discussed at the GC0106 Workgroup meetings planned following the closure of this Consultation.	

Grid Code Workgroup Consultation Response Proforma

GC0106 Data exchange requirements in accordance with Regulation (EU) 2017/1485 (SOGL)

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **5pm** on **27 April 2018** to grid.code@nationalgrid.com. Please note that any responses received after the deadline or sent to a different email address may not receive due consideration by the Workgroup.

Any queries on the content of the consultation should be addressed to Chrissie Brown at Christine.brown1@nationalgrid.com

Respondent:	*Susan Mwape* *susan.mwape@nationalgrid.com*
Company Name:	*National Grid*
Please express your views regarding the Workgroup Consultation, including rationale. **(Please include any issues, suggestions or queries)**	*For reference, the Grid Code objectives are:* i. To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity ii. To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity) iii. Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole iv. To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and v. To promote efficiency in the implementation and administration of the Grid Code arrangements. *The Distribution Code objectives are:* i. Permit the development, maintenance, and operation of an efficient, coordinated and economical System for the distribution of electricity. ii. Facilitate competition in the generation and supply of electricity.

	iii. Efficiently discharge the obligations imposed upon DNOs by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators. iv. Promote efficiency in the implementation and administration of the Distribution Code.

Standard Workgroup Consultation questions

Q	Question	Response
1	Do you believe that GC0106 Original proposal, or any potential alternatives for change that you wish to suggest, better facilitates the Grid Code Objectives?	The original proposal positively facilitates efficiency in discharging the obligations imposed upon the licensee and all relevant legally binding decisions of the European commission and the Agency. The proposal aligns with guidance from BEIS and Ofgem to apply the new EU requirements within the existing GB regulatory frameworks and to use the existing governance processes. Following this approach provides accessibility and familiarity to all GB parties as well as promoting efficiency in the implementation and administration of the Grid Code arrangements. The key aim of the regulation on data exchange is to allow for TSOs to exchange data with neighbouring TSOs in a harmonised approach. In the case of GB synchronous area the observability area does not currently stretch into neighbouring countries therefore there is benefit is maintaining the existing GB data exchange between TSOs, DSOs and SGUs as that data is currently sufficient for state estimation. GB common grid models are already submitted to the EU platforms using existing data as required by regulation on capacity allocation and congestion management. Future changes are necessary hence there is merit in raising future Grid Code changes through other work streams that are going on to support the change in roles for the distribution and transmission system operator functions.
2	Do you support the proposed implementation approach?	Yes
3	Do you have any other comments?	
4	Do you wish to raise a WG Consultation Alternative Request for the Workgroup to consider?	*If yes, please complete a WG Consultation Alternative Request form, available on National Grid's website, https://www.nationalgrid.com/uk/electricity/codes/grid-*

		code and return to the Grid Code inbox at grid.code@nationalgrid.com

Specific GC0106 questions

Q	Question	Response
5	For those respondents that the Workgroup believes are directly affected by the GC0106 proposal (i.e. (i) new Type A power generating modules of less than 16A per phase, (ii) DNOs and (iii) CDSOs) do you agree with the proposed revised data exchange requirements? Do you have any comments on the drafting of the associated legal text set out in Annexes 4, 6 and 7?	
6	Do you believe that the solution described in this Workgroup Report discharges the legal obligations of the SOGL and other relevant EU legislation?	Yes. In line with Ofgem advice, the original proposal seeks to make only those changes necessary to the Grid code and Distribution Code to ensure compliance with SOGL and KORRR. Article 40.5 SOGL allows for TSO discretion on the application of some of the Articles through determining the applicability and scope for some of the structural, scheduling and real time data. This proposal therefore has a focus on making changes only in relation to the mandatory Articles with no TSO discretion. The solution builds upon the existing market structure arrangements that apply to large, medium and small providers. National Grid and DNOs currently have sufficient data to operate the transmission and distribution systems respectively in an efficiently and coordinated manner. In order to meet SOGL compliance it is sufficient to maintain the status quo. In GB the Grid and Distribution Codes are aligned to allow for the necessary data exchange between them and for SGUs connected to the respective networks. The proposed changes will ensure compliance of mandatory changes and where flexibility is adopted future changes will be raised in accordance with changes to the system operation roles for both distribution and transmission. Setting stringent data exchange requirements may stifle innovation in growing markets particularly for demand side providers. Implementing non-mandatory changes may lead to financial investments with little benefit to the TSO. This may put compliance at risk as the deadline is 14 March 2019.

7	For those parties that the Workgroup believes are not directly affected by the GC0106 proposed revised data exchange requirements, do you have any comments on the approach and/or legal drafting?	
8	Do you have any views on the legal interpretation aspects set out in Section 9 together with the explanatory information in Annexes 2 and 3?	The wording in articles 44, 47 – 53 in SOGL , "unless otherwise provided by the TSO,…" provides some flexibility in agreement of the applicability and scope of data exchange. The key aim is to exchange data with other TSO in the case of GB, currently there is no requirement to exchange data with a neighbouring TSO so we support the legal interpretation which was echoed in a letter from the European Commission to EU DSOs. This approach and aligns with the Regulator's guidance on implementing EU code changes.
	Legal text comments	The legal text for PC.A.3.1.4 will be amended such that it does not refer to each embedded power station as suggested below: (iii) beginning from the 2019 Week 24 data submission, for Embedded Small Power Stations with Registered Capacity of 1MW or less, their best estimate of the aggregated capacity of all such Embedded Small Power Stations per production type as defined the list in PC.A.3.1.4 (a)(ii)(2)(a).
	If you believe there are issues in the legal text, can you please bring these to our attention by using the space provided here. These will then be discussed at the GC0106 Workgroup meetings planned following the closure of this Consultation.	

THE DISTRIBUTION CODE

OF LICENSED DISTRIBUTION NETWORK OPERATORS OF GREAT BRITAIN

Issue 3~~68~~ – ~~10 December 2018~~14 February 2019

GUIDANCE NOTE 2/6~~5~~

First issued 03 March 2011 – updated 06 October 2011

Second Issue 29 March 2012

Third Issue December 2012.

Fourth Issue September 2013

Fifth Issue May 2018

Sixth Issue February 2019

ENGINEERING RECOMMENDATIONS G83 AND G59

This guidance note was originally issued on 03 March 2011 and its main provision was to allow the use small scale generation of capacity greater than 16A per phase, provided it had been type tested to the requirements of G83/1-1 but with a modified over frequency protection setting.

The guidance note only applies to small scale generation first connected before 27 April 2019. When the requirements of the EU Network Code "Requiremenets for all generators" comes into effect on 27 April 2019 it will be necessary for all small scale generation connected on or after that date to comply with the requirements of EREC G98 or EREC G99 as appropriate.

Previous updates to this note changed the applicable dates to allow a period of grace following the introduction of revised versions of G59 and G83 in which manufacturers can adapt their equipment to the changed requirements of these documents.

For G83/2 and G59/3 the Distribution Code Review Panel wishes to see the following continuing interpretation:

- For all small scale embedded **Power Generating Module**s of up to and including 16A per phase (provided that the aggregate capacity of installed generation is less than or equal to 16A per phase), until 1 March 2014 it is permissible to connect to the general requirements of previous versions of G83 provided this is through an inverter or controller with a protection/control system that has either been fully type tested in accordance with G83/1-1, G83/2 or in accordance with G59/2. After 1 March 2014 it will only be allowable to connect small scale embedded generation of up to and including 16A per phase that complies with G83/2 (or with G59/3-1for small scale embedded **Power Generating Module**s non-compliant with G83/2). From 1 July 2018 it will only be allowable to connect small scale embedded generation of up to and including 16A per phase that complies with G83/2-1 (or any subsequent amendment of G83), or with G59/3-4 for small scale embedded generation sets non-compliant with G83/2-1~~)~~. Note that from 27 April 2019 it will only be possible to connect in accordance with EREC G98 (or EREC G99 for small scale embedded **Power Generating Module**s not compliant with EREC G98).

- Connection of small scale embedded generation of above 16A per phase (including the connection of small scale embedded generation of less than 16A per phase where the aggregate capacity of installed generation is greater than 16A per phase) made before 1 December 2014 can be in accordance with either G59/2-1 or G59/3-2. Such connections

ANNEX 1 - QUALIFYING STANDARDS

This Annex forms part of the **Distribution Code** technical requirements.

Distribution Code Requirements Implemented via Electricity Supply Standards

Copies of the following Engineering Recommendations and Technical Specifications are freely available from the **Distribution Code** website at **http://www.dcode.org.uk/** or from Energy Networks Association, 4 More London Riverside, London SE1 2AU, http://**www.energynetworks.org**/. A copy of Engineering Memorandum PO-PS-037 is available from Scottish Hydro Electric Power Distribution Ltd on request.

1 **Engineering Recommendation G5/4-1**

Planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission and distribution systems in the United Kingdom.

2 **Engineering Recommendation G12/4-1**

Requirements for the application of protective multiple earthing to low voltage networks.

3 **Engineering Recommendation G59/3-4**

Recommendation for the connection of generating plant to the distribution systems of licensed distribution network operators

4 (a) **Engineering Recommendation P2/6**

Security of Supply.

(b) **EM PO-PS-037**

Distribution planning standards of voltage and of security of supply. (Parts of Scottish Hydro Electric Power Distribution Ltd Area)

5 **Engineering Recommendation P24**

AC traction supplies to British Rail.

6 **Engineering Recommendation P25**

The short-circuit characteristics of single-phase and three-phase low voltage distribution networks

7 **Engineering Recommendation P28**

Planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the United Kingdom.

8 **Engineering Recommendation P29**

Planning limits for voltage unbalance in the United Kingdom for 132kV and below.

9 **Technical Specification 41-24 Issue 2**

Guidance for the design, installation, testing and maintenance of main earthing systems in substations

10 **Engineering Recommendation S34 Issue 2**

A guide for assessing the rise of earth potential at electrical installations.

11 **Engineering Recommendation G83/2-~~1~~2**

Recommendations For The Connection of Type Tested Small-Scale Embedded Generators (Up To 16 A Per Phase) In Parallel With Public Low-Voltage Distribution Networks.

12 **Engineering Recommendation G98 Issue 1 Amendment ~~2~~3**

Requirements for the connection of type-tested micro generators (up to and including 16 A per phase) in parallel with public low voltage distribution networks on or after 27 April 2019

13 **Engineering Recommendation G99 Issue 1 Amendment 3**

Requirements for the connection of generating equipment in parallel with public distribution networks on or after 27 April 2019

DISTRIBUTION PLANNING AND CONNECTION CODE 8

DPC8 TRANSFER OF PLANNING DATA

DPC8.1 **Introduction**

DPC8.1.1 **Distribution Planning and Connection Code** DPC8 details information to be exchanged between the **DNO** and **Users** that are connected at **High Voltage** including **Embedded Generators** and **Other Authorised Distributors**.

It includes data that is necessary in order for the **DNO's Distribution System** to be developed in an efficient, co-ordinated and economic manner, and to enable the **DNO** to comply with the conditions contained in its **Distribution Licence.**

DPC8.2 **Planning Information to be Provided by Users**

DPC8.2.1 Prospective and existing **Users** of the **DNO's Distribution System** must provide sufficient planning data/information as can reasonably be made available, when requested by the **DNO** from time to time to enable the **DNO** to comply with the requirements under its **Distribution Licence**. For those **Users** from whom **Demand** forecasts are required under **DOC1**, there will be a requirement to prepare an annual submission to the **DNO**. This submission, which is to be in accordance with **DOC1**, should include a development plan covering at least the subsequent 3 years and, where the **User** holds planning data or information relating to subsequent years up to 7 years ahead that data or information, including changes either increasing or decreasing in **Demand**, transfer requirements or generating capacity as appropriate.

DPC8.2.2 In addition to periodic updates of planning information a **User** should give adequate notice of any significant changes to the **User's System** or operating regime to enable the **DNO** to prepare its development plan, budget for, and implement any necessary **System** modifications. Such information should include any changes either increasing or decreasing in **Demand**, transfer requirements or generating capacity as appropriate. In the event of unplanned changes in a **User's System** or operating regime a **User** shall notify the **DNO** as soon as is practically possible to ensure any contingency measures, as necessary, can be implemented by the **DNO**.

DPC8.2.3 The **DNO** has an obligation under the **CUSC** to submit certain planning data/information relating to **Existing Offshore Generators** to **NGC**. Any **Existing Offshore Generators** will be required to cooperate with the **DNO** to contribute to the full and timely completion of the **Offshore Transmission Implementation Plan.**

DPC8.3 **Information to be Provided to Users**

DPC8.3.1 Where the **DNO** has received from a **User** any information or data under DPC8.3 or where the **DNO** proposes to make modifications to the **DNO's Distribution System** which, in either case, in the reasonable opinion of the **DNO**, may have an impact upon the **System** of any other **User,** the **DNO** will notify that **User** of the proposals subject to any constraints relating to the timing of release of information or confidentiality provisions.

DPC8.3.2 On request from a **User**, the **DNO** will notify the **User** of all the data submitted by and relating to that **User** that the **DNO** is holding and using for **Distribution Code** purposes.

DPC8.4 **Reactive Compensation Plant**

DPC8.4.1 A **User** shall provide the **DNO** with information on any reactive compensation **Plant** directly or indirectly connected to a **DNO's Distribution System**, other than at **Low Voltage**, including:-

(a) The MVAr capacitive or inductive rating of the **Equipment** and operating range if variable;

(b) Details of any automatic control logic such that the operating characteristics can be determined; and

(c) The point of connection to the **DNO's Distribution System**.

DPC8.5 **Lumped Network Susceptance**

DPC8.5.1 Under certain circumstances it will be necessary for the **User** to provide, at the request of the **DNO**, details of the equivalent lumped network susceptance at **Normal Frequency** of the **User's System** at nominal **Frequency** referred back to the connection with the **DNO's Distribution System**. This should include any shunt reactors which are an integrated part of a cable system and which are not normally in or out of service independent of the cable (ie. they are regarded as part of the cable).

DPC8.5.2 It should not include:-

(a) Independently switched reactive compensation plant connected to the **User's System** (covered in DPC8.4.1)

(b) Any susceptance of the **User's System** inherent in the **Reactive Power Demand**.

DPC8.6 **Short Circuit Infeed to the DNO's Distribution System**

DPC8.6.1 Information shall be exchanged between the **DNO** and the **User** on fault infeed levels at the point of connection with the **DNO's Distribution System** in the form of:-

(a) The maximum and minimum 3-phase symmetrical and phase earth short circuit infeed.

(b) The X/R ratio under short circuit conditions.

(c) In the case of interconnected **Systems**, adequate equivalent network information.

DPC8.7 **Interconnection Impedance**

DPC8.7.1 For **User** interconnections that operate in parallel with the **DNO's Distribution System** details of the interconnection impedance shall be exchanged between the **DNO** and the **User.** This information shall include an equivalent single impedance (resistance, reactance and shunt susceptance) of the parallel **User** or **DNO's Distribution System**.

29	01/02/18	Modification to DPC7.4.3.4 and DPC7.4.3.7 to change RoCoF compliance requirements,and prohibit the future use of vector shift as LoM protection. Replace reference to ER G59/3-2 with ER G59/3-3
30	01/03/18	To take cognisance of the revision to EREC P25 (amalgamation of ER P25 and ERP26). Modification to Annex 1 list and DPC4.3.2, DPC4.4.1 and DPC6.5.1. Remove reference to ER P26.
31	16/05/18	Definition of Small, Medium and Large Power Stations altered to incorporate introduction of the European Network Code Requirements for Generators. Modification to DPC 7 to allow for compliance with the European Network Code Requirements for Generators achieved by the introduction of Engineering Recommendations G98 and G99. Removal of G59 duplicate clauses: • DPC7.1.4 and DPC7.1.5 Parallel operation • DPC7.2.2 and DPC7.2.4 Isolation and safety labelling • DPC7.2.5 Disconnection • DPC7.2.6 Operational & Safety • DPC7.2.8 Synchronising • DPC7.4.1.3 Frequency Operating Range • DPC7.4.3.4, DPC7.4.3.5 and DPC7.4.3.6, DPC7.4.3.9 Protection DOC 5 clarification around Medium Power Stations.
32	01/07/18	Update of G59/3-3 to G59/3-4, and G83/2 to G83/2-1 throughout. Minor update to Guidance Note to reflect this change.
33	23/07/18	Correction of compliance date for G98 and G99 from 17 May 2019 to 27 April 2019; update of references to G98 and G99 for the housekeeping mods to those two documents.
34	10/09/18	New DPC9 (and associated definitions) added to implement the Demand Connexion Code.
35	08/11/18	Update to Annex 1 to include new references to EREC S34 Issue 2 and TS 41-24 Issue 2.
36	10/12/18	Updated to include new references to EREC G98 Issue 1 Amendment 2 and to EREC G99 Issue 1 Amendmenet 3.
37	[04/02/19]	NGC replaced with NGESO or NGET as appropriate, reflecting the separation of National Grid's transmission lience into system operator and transmission asset owner.
38	[14/02/19]	Update references in Annex 1 to EREC G83 and EREC G98. Consequential modification to Guidance Note 2. New clause DPC 8.3.2 implementing reciprocal data rights for Users as required by KORRR article 5.

END

Engineering Recommendation G83

Issue 2 Amendment ~~1~~ 2 (July 2018)

Recommendations for the Connection of Type Tested Small-scale Embedded Generators (Up to 16A per Phase) in Parallel with Low-Voltage Distribution Systems

Operations Directorate
Energy Networks Association
6th Floor, Dean Bradley House
52 Horseferry Rd
London
SW1P 2AF

First published, October, 2002

Amendments since publication

Issue	Date	Amendment
Issue 1	September 2003	Revision
Issue 1-1	June 2008	Revision (ammendment1)
Issue 2	December, 2012	Full revision of the previous version G83/1-1 2008 to ensure alignment with the requirements of EREC G59/2
Issue 2-1	01 July 2018	RoCoF and VS immunity requirements – amendments to; 5.3.1, 5.3.3, Appendix 4
Issue 2-2	[14 February 2018]	Amendments to add new fuel/technology type to Appendix3

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1 Foreword

This Engineering Recommendation (EREC) is published by the Energy Networks Association (ENA) and comes into effect from 1 December 2012[1].

It has been prepared and approved under the authority of the **Great Britain Distribution Code Review Panel.** The approved abbreviated title of this engineering document is "EREC G83", which replaces the previously used abbreviation "ER G83".

The purpose of this Engineering Recommendation is to simplify and standardise the technical requirements for connection of **Small Scale Embedded Generators** (**SSEGs**) for operation in parallel with a public low-voltage **Distribution System,** by addressing all technical aspects of the connection process from standards of functionality to site commissioning.

The procedures described are designed to facilitate the connection of **Type Tested SSEGs** whilst maintaining the integrity of the public low-voltage **Distribution System**, both in terms of safety and supply quality.

This Engineering Recommendation provides sufficient information to allow:

a) **SSEG Manufacturers** to design and market a product that is suitable for connection to the public low-voltage **Distribution System**;

b) **Users**, **Manufacturers** and **Installers** of **SSEGs** to be aware of the requirements that will be made by the **Distribution Network Operator** (**DNO**) before the **SSEG** installation will be accepted for connection to the **DNO's Distribution System.**

Legal Aspects

In accordance with **ESQCR** Regulation 22(2)(c) the **Installer** is to ensure that the **DNO** is made aware of the **SSEG** installation at or before the time of commissioning. The **DNO** may not refuse to accept the connection providing the installation complies with the requirements of **ESQCR** Regulation 22. However under the terms of **ESQCR** Regulation 26 the **DNO** may require a **SSEG** to be disconnected if it is a source of danger or interferes with the quality of supply to other consumers.

In August 2008 an exemption to **ESQCR** Regulation 22(2) (c) was granted by the Health & Safety Executive to the person or persons installing the source of energy from the requirements imposed by **ESQCR** Regulation 22(2)(c) as long as that person or persons installing the source of energy informed the **DNO** of the intention to use that source of energy in parallel with the network no later than 28 days (inclusive of the day of commissioning) after commissioning the source (see Appendix 6)

In addition to the requirements specified in this document which allows connection to the GB electricity Distribution System, the SSEG and all of its components shall comply with all relevant legal requirements including European Directives and CE marking.

[1] Distribution Code Guidance Note 2/4 - December 2012. - http://www.energynetworks.info/the-distribution-code/

For all Small Scale Embedded Generators (SSEG) of up to 16A per phase, until 1 March 2014 it is permissible to connect to the general requirements of previous versions of G83 provided this is through an Inverter or Controller with a protection/control system that has either been fully type tested in accordance with G83/1-1, G83/2, G83/2-1 or in accordance with G59/2.

After 1 March 2014 it will only be allowable to connect SSEG of up to 16A per phase that complies with G83/2 or ~~G83/2-1~~any subsequently amended version of G83. .

2 Scope

This Engineering Recommendation provides guidance on the technical requirements for the connection of **Type Tested Small-Scale Embedded Generators** (**SSEGs**) in parallel with public low-voltage distribution networks. For the purposes of this Engineering Recommendation a **SSEG** is a source of electrical energy rated up to and including 16 Ampere per phase, single or multi- phase, 230/400 V **AC**.
This corresponds to 3.68 kilowatts (kW) on a single-phase supply and 11.04 kW on a three-phase supply. The kW rating shall be based on the nominal voltage (ie 230V) as defined in BS EN 50160 and the Electricity Supply Quality and Continuity Regulations (ESQCR).

Where the **SSEG** includes an **Inverter** its rating is deemed to be the **Inverter's** continuous steady state rating.

There are two connection procedures described in this document.

The first connection procedure covers the connection of one or more **SSEG** systems, either single or multi-phase within a single **Customer's Installation**.
Multiple **SSEG** systems shall be accepted within a single **Customers Installation** provided that the aggregate rated capacity of the systems is not greater than 16A per phase[2].

The second connection procedure covers the connection of multiple **SSEGs** (other than within a single **Customer's Installation**) in a **Close Geographic Region**, under a planned programme of work.

This Engineering Recommendation only specifies the connection requirements applicable to those **SSEG** installations that are designed to normally operate in parallel with a public distribution network. Those installations that operate in parallel with the **DNO's Distribution System** for short periods (ie less than 5 minutes) or as an islanded installation or section of network are considered to be out of scope, on the basis that it is not possible to devise generic rules that will ensure safe operation under all operating conditions.

The generic requirements for all types of **SSEG** systems are defined in the main text of this Engineering Recommendation, whilst the generic and technology specific type testing requirements are defined in the annexes. The generic requirements relate to the connection, installation and network design requirements for connection of a **SSEG** to a public low-voltage **Distribution System**. **SSEGs** that are not **Type Tested** to conform to the requirements of this document can only be connected via the guidelines laid down in Engineering Recommendation G59.

Annexes A and B describe a methodology for testing the particular types of electrical interface between the **SSEG** and the **Distribution System** whilst Annex C describes a methodology for testing technology specific **SSEG** requirements. The purpose of the type tests is to demonstrate compliance with the generic requirements of this Engineering Recommendation. By satisfying the test conditions in the relevant annex the **SSEG** can be considered an approved **SSEG** for connection to a public low-voltage **Distribution System**.
In the event that a new type testing annex is required then this should be formally initiated by the **GB Distribution Code Review Panel (DCRP)**.

[2] The manufacturer may restrict the rating of the SSEG by applying software settings provided these settings are not accessible to the customer

The Appendices contain pro forma that relate to the connection, commissioning, type testing, and decommissioning of **SSEGs**.

This document does not remove any statutory rights of an individual or organisation; equally it does not remove any statutory obligation on an individual or organisation.

Connection agreements (ie the legal documentation supporting the connection of a **SSEG**), energy trading and metering are considered to be out of scope. These issues are mentioned in this document only in the context of raising the reader's awareness to the fact that these matters might need to be addressed

3 Normative References

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 7671: 2008 Requirements for Electrical Installations
IEE Wiring Regulations Seventeenth (Amendment 1 2011) Edition.

BS EN 50160: 2010
Voltage characteristics of electricity supplied by public electricity networks.

BS EN 50438: 2008
Requirements for the connection of micro-generators in parallel with public low-voltage distribution networks.

BS EN 60034-4:2008
Methods for determining synchronous machine quantities from tests.

BS EN 60255 series*
Measuring relays and protection equipment.

BS EN 60664-1: 2007
Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests (IEC 60664-1:2007).

BS EN 60947 series*
Low Voltage Switchgear and Controlgear.

BS EN 61000-3-2:2006+A2:2009
Limits for harmonic current emissions (equipment input current up to and including 16 A per phase).

BS EN 61000-3-3:2008
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16A per phase and not subject to conditional connection.

BS EN 61000 series*
Electromagnetic Compatibility (EMC).
BS EN 61508 series*

Functional safety of electrical/ electronic/ programmable electronic safety-related systems.

BS EN 61810 series*
Electromechanical Elementary Relays.

BS EN 62116
Test procedure of islanding prevention measures for utility-interconnected photovoltaic **Inverters**.

IEC 60255-5: 2001
Electrical relays. Insulation coordination for measuring relays and protection equipment. Requirements and tests.

IEC 60725
Considerations or reference impedances for use in determining the disturbance characteristics of household appliances and similar electrical equipment.

IEC 60909-1 (Second Edition): 2002
Short circuit calculation in three-phase **AC** systems.

IEC 62282-3-2 ed1.0: 2006
Fuel cell technologies - Part 3-2: Stationary fuel cell power systems - Performance test methods.

Where standards have more than one part, the requirements of all such parts shall be satisfied, so far as they are applicable.

Other publications

Health and Safety at Work etc Act (HASWA): 1974
The Health and Safety at Work etc Act 1974 also referred to as HASAW or HSW, is the primary piece of legislation covering occupational health and safety in the United Kingdom. The Health and Safety Executive is responsible for enforcing the Act and a number of other Acts and Statutory Instruments relevant to the working environment.

Electricity Safety, Quality and Continuity Regulations (ESQCR)
The Electricity Safety, Quality and Continuity Regulations 2002 - Statutory Instrument Number 2665 -HMSO ISBN 0-11-042920-6 abbreviated to ESQCR in this document.

Electricity at Work Regulations (EaWR): 1989
The Electricity at Work regulations 1989 abbreviated to EaWR in this document.

Engineering Recommendation G5/4-1 (2005)
Planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission and distribution networks in the United Kingdom.

Engineering Recommendation G59/2, Amendment 1 (2011)
Recommendations for the Connection of Embedded Generating Plant to the Distribution Systems of Licensed Distribution Network Operators.

Engineering Recommendation P28 (1989)
Planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the United Kingdom.

Engineering Recommendation P29 (1990)

Planning limits for voltage unbalance in the UK for 132kV and below.

Engineering Recommendation G74 (1992)
Procedure to meet the requirements of IEC 60909 for the calculation of short-circuit currents in three-phase **AC** power systems.

4 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

NOTE: Defined terms are capitalised and in bold script where they are used in the main text of this report.

Alternating Current or AC
An electric current that reverses direction in a circuit at regular intervals.

Act
The Electricity Act 1989 (as amended by the Utilities Act 2000 and the Energy Act 2004).

Apparatus
All **Equipment,** in which electrical conductors are used, supported or of which they may form a part.

Authorised Electricity Operators
Any person (other than the **DNO** in its capacity as an operator of a **Distribution System**) who is authorised to generate, participate in the transmission of, distribute or supply electricity.

Authority
The Gas and Electricity Markets Authority established under Section 1 of the Utilities Act 2000.

Circuit Breaker
An automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit.

Close Geographic Region
A close geographic region is defined as the area typically served by a single low voltage feeder circuit fed from a single distribution transformer. In a situation where this definition cannot be reliably applied by an **Installer,** the **Installer** can either confirm with the DNO whether a proposed **SSEG** is in a **Close Geographic Region** or ensure that at least one of the following criteria is met:

1) The postcodes of any of the premises where a **SSEG** installation is planned by the same organisation are the same when the last two letters are ignored…i.e. AB1 2xx, where xx could be any pair of letters or where x could be any letter.

2) The premises where a **SSEG** installation is planned by the same organisation are within 500m of each other.

Connection Point
An **Entry Point** or an **Exit Point** of the **Distribution System** as the case may be**.**

Controller
A device for controlling the functional operation of an **SSEG.**

Converter
The generic name for electronic architecture that, for the purpose of this recommendation, converts either an alternating (**AC**) or direct (**DC**) current input into alternating current (**AC**) output suitable for direct connection to the **DNO's Distribution System.**

Customer
Any person supplied or entitled to be supplied with electricity at any premises within **Great Britain** but shall not include any **Authorised Electricity Operator** in its capacity as such.

NOTE: Other documentation may use the term *Consumer* when making reference to the functions and/or features that this document has attributed to the **Customer**.

Customer's Installation
The electrical installation on the **Customer's** side of the **Exit Point** together with any equipment permanently connected or intended to be permanently connected thereto.

Customer With Own Generation
A **Customer** with one or more **Generation Sets** connected to the **Customer's System**, providing all or part of the **Customer's** electricity requirements**,** and which may use the **DNO's Distribution System** for the transport of any surplus of electricity being exported.

Direct Current or DC
The movement of electrical current flows in one constant direction, as opposed to **Alternating Current or AC,** in which the current constantly reverses direction.

Distribution Code
A code required to be prepared by a **DNO** pursuant to condition 9 (**Distribution Code**) of a **Distribution Licence** and approved by the **Authority** as revised from time to time with the approval of, or by the direction of, the **Authority**.

Distribution Code Review Panel (DCRP)
The standing body established under the **Distribution Code**.

Distribution Licence
A distribution licence granted under Section 6(1)(c) of the **Act**.

Distribution Network Operator (DNO)
The person or legal entity named in Part 1 of the **Distribution Licence** and any permitted legal assigns or successors in title of the named party.

Distribution System
The electrical network operated by an **Other Authorised Distributor.**

DNO's Distribution System
The **System** consisting (wholly or mainly) of electric lines owned or operated by the **DNO** and used for the distribution of electricity

Equipment
Plant and/or **Apparatus.**

Embedded Generator
A **Generator** including a **Customer With Own Generation** whose **Generating Units** are directly connected to the **DNO's Distribution System** or to an **Other Authorised Distributor** connected to the **DNO's Distribution System.**

Entry Point
The point at which an **Embedded Generator** or other **Users** connect to the **DNO's Distribution System** where power flows into the **DNO's Distribution System** under normal circumstances**.**

Exit Point
Means the ends of the electric lines at which the supply is delivered to a **Customer's Installation.**

Generator
A person who generates electricity under licence or exemption under the **Act.**

Generation Set
Any **Apparatus** which produces electricity.

Generating Unit
Any **Apparatus** which produces electricity.

Great Britain or GB
The landmass of England & Wales and Scotland, including internal waters.

Installer
The person who is responsible for the installation of the **SSEG**.

Interface Protection
The electrical protection required to ensure that the **SSEG** is disconnected for any event that could impair the integrity or degrade the safety of the **Distribution System**. This protection will normally include the elements detailed in Table 1 of this Engineering Recommendation.

Inverter
A device for conversion from **Direct Current** to nominal frequency **Alternating Current**.

Islanding
Any situation where a section of electricity system, containing generation, becomes physically disconnected from the **DNO's Distribution System** or **User's Distribution System**; and one or more **Generating Units** maintains a supply of electrical energy to that isolated system.

Low Voltage or LV
In relation to **Alternating Current**, a voltage exceeding 50 volts but not exceeding 1000 volts**.**

Manufacturer
A person or organisation that manufactures **SSEG** and also 'packages' components manufactured by others to make a **SSEG** which can be **Type Tested** to meet the requirements of this Engineering Recommendation.

Meter Operator
A person, registered with the registration **Authority**, appointed by either a **Supplier** or **Customer** to provide electricity meter operation services. (This **Distribution Code** does not place any direct obligation on **Meter Operators** other than through the appointment by either a **Supplier** or a **Customer**.)

Nominal Voltage and Frequency
Low voltage: 230 volts **AC** (+10/-6 %) single-phase, 50 Hz (±1%).400 volts **AC** (+10/-6 %) three phase, 50 Hz (±1%). 230-460 volts **AC** (+10/-6%) split phase.

NOTE: **DNO** voltage and frequency is referenced to the **Exit Point.**

Plant
Fixed and movable items used in the generation and/or supply and/or transmission of electricity other than **Apparatus**.

Other Authorised Distributor
A **User** authorised by Licence or exemption to distribute electricity and having a **User Distribution System** connected to the **DNO's Distribution System.**

Quality Factor, *Qf*
A measure of the strength of resonance of the **Islanding** test load.

NOTE: In a parallel resonant circuit, such as a load on a power system.

$$Q_f = R\sqrt{\frac{C}{L}}$$

Where Q_f is quality factor, R is effective load resistance, C is reactive load capacitance (including shunt capacitors), and L is reactive load inductance.

On a power system with active power, P, and reactive powers, Q_L, for inductive load, and Q_C for capacitive load, Q_f can be determined by:

$$Q_f = \frac{1}{P}\sqrt{|Q_L| \cdot |Q_C|}$$

Where P is active power, in W, Q_L is inductive load, in VAr, and Q_C is capacitive load, in VAr.

Small Scale Embedded Generator (SSEG)
A **Generating Unit** together with any associated interface equipment, if required, (eg **Inverter(s))** that can be used independently, rated up to and including 16A per phase, single or multi-phase 230/400V **AC** and designed to operate in parallel with a public low voltage **Distribution System**. 16A is equivalent to 3.68kW on a single-phase supply and 11.04kW on a three-phase supply. Where the **SSEG** includes an **Inverter** its rating is deemed to be the **Inverter's** continuous steady state rating.

Supplier
(a) A person supplying electricity under an Electricity Supply Licence; or

(b) A person supplying electricity under exemption under the **Act**; in each case acting in its capacity as a **Supplier** of electricity to **Customers**.

System
An electrical network running at various voltages.

Type Tested
An **SSEG** design which has been tested by the **Manufacturer**, component manufacturer or supplier, or a third party, to ensure that the design meets the requirements of this Engineering Recommendation, and for which the **Manufacturer** has declared that all products supplied will be constructed to the same standards, and with the same protection settings as the tested product.

User
A term used in various sections of the **Distribution Code** to refer to the persons using the **DNO's Distribution System**.

5 Connection, Protection & Testing Requirements

5.1 Connection Procedure

5.1.1 Single Premises Connection Procedure

In most instances the installation of a single **SSEG** or multiple **SSEGs** (provided that the aggregate installed capacity is no greater than 16A per phase) within a single **Customer's Installation**, connected in parallel with the public **Distribution System,** will have negligible impact on the operation of the **Distribution System**; as such there will be no need for the **DNO** to carry out detailed network studies to assess the impact of the connection. As required by the **ESQCR** Certificate of Exemption (2008) (see Appendix 6) the **Installer** shall provide the **DNO** with all necessary information on the installation no later than 28 days after the **SSEG**(s) have been commissioned; the format and content shall be as shown in Appendix 3.

This procedure will not apply where an **Installer** plans (within the next 28 days) or has already installed (in the previous 28 days) other **SSEG**s in a **Close Geographic Region**; in this case the procedure in 5.1.2 shall be followed. Failure to comply with this requirement may lead to the disconnection of the **Customer's Installation** under ESQCR (26) or failure of the **SSEG** to operate as intended.

5.1.2 Multiple Premises Connection Procedure

In the case of projects where the proposal is to install single or multiple **SSEGs** in a number of **Customers Installations** in a **Close Geographic Region,** the **Installer** shall discuss the installation project with the local **DNO** at the earliest opportunity. The **DNO** will need to assess the impact that these connections may have on the network and specify conditions for connection. The initial application will need to be in a format similar to that shown in Appendix 2. Connection of the **SSEG** is only allowed after the application for connection has been approved by the **DNO** and any **DNO** works facilitating the connection have been completed. Confirmation of the commissioning of each **SSEG** system will need to be made no later than 28 days after commissioning; the format and content shall be as shown in Appendix 3.

5.2 Installation Wiring and Isolation

The installation that connects the **SSEG** to the **Exit Point** shall comply with the requirements of BS 7671. All wiring between the **Exit Point** and the **SSEG** shall be protected by a suitably rated protective device; and shall be of suitable size and type for the rating of the **SSEG**. The **SSEG(s)** shall be connected via an accessible isolation switch that is capable of isolating all

phases and neutral. The isolation switch shall be capable of being secured in the 'off' (isolated) position.

5.3 Interface Protection

The purpose of the **Interface Protection** is to ensure that the connection of a **SSEG** system will not impair the integrity or degrade the safety of the **DNO's Distribution System**. The interface protection may be located in a separate unit or integrated into the **SSEG** (the **Inverter** in the case of technologies which connect via an **Inverter**).

The **DNO** is responsible under the **Distribution Code** for ensuring, by design, that the voltage and frequency at the **Connection Point** remains within statutory limits. The G83 **Interface Protection** settings have been chosen to allow for voltage rise or drop within the **Customer's Installation** and to allow the **SSEG** to continue to operate outside of the statutory frequency range as required in the **Distribution Code**.

5.3.1 Interface Protection Settings and Test Requirements

Interface Protection shall be installed which disconnects the **SSEG** system from the **DNO**'s **Distribution System** when any parameter is outside of the settings shown in Table 1.

Table 1 Protection Settings

Protection Function	Trip Setting	Trip Delay Setting (Time)
U/V stage 1	Vφ-n† -13% = 200.1V	2.5s
U/V stage 2	Vφ-n† - 20% = 184V	0.5s
O/V stage 1	Vφ-n† +14% = 262.2V	1.0s
O/V stage 2	Vφ-n†+ 19% = 273.7V[3]	0.5s
U/F stage 1	47.5Hz	20s
U/F stage 2	47Hz	0.5s
O/F stage 1	51.5Hz	90s
O/F stage 2	52 Hz	0.5s
Loss of Mains*¶ (RoCoF)	1.0 Hzs^{-1}	0.5s

† A value of 230V phase to neutral

* Other forms of Loss of Mains techniques may be utilised but the aggregate of the protection operating time, disconnection device operating time and trip delay setting shall not exceed 1.0 second.

¶The required protection requirement is expressed in Hertz per second (Hzs^{-1}). The time delay should begin when the measured RoCoF exceeds the threshold expressed in Hz/s. The time delay should be reset if measured RoCoF falls below that threshold. The relay must not trip unless the measured rate remains above the threshold expressed in Hzs^{-1} continuously for 500ms. Setting the number of cycles on the relay used to calculate the RoCoF is not an acceptable implementation of the time delay since the relay would trip in less than 500ms if the system RoCoF was significantly higher than the threshold.

The total disconnection time for voltage and frequency protection including the operating time of the disconnection device shall be the trip delay setting with a tolerance of, -0 s + 0.5s.

For the avoidance of doubt voltage and frequency excursions lasting less than the trip delay setting shall not result in disconnection.

[3] For grid surge voltages greater than 230V +19% which are present for periods of <0.5s the **SSEG** is permitted to reduce/cease exporting in order to protect the equipment.

All settings shall be applied as shown in the above table, so that they can be inspected if required by the **DNO** to confirm that the settings are correct. Only devices that have protection settings set and locked during manufacture can be considered as **Type Tested.**

The **Manufacturer** needs to establish a secure way of displaying the settings in one of the following ways.

a) A display on a screen which can be read;
b) A display on a PC which can communicate with the device and confirm that it is the correct device by means of a serial number permanently fixed to the device and visible on the PC screen at the same time as the settings;
c) Display of all settings including nominal voltage and current outputs, alongside the serial number of the device, permanently fixed to the device.

The provision of loose documents, documents attached by cable ties etc, a statement that the device conforms to a standard, or provision of data on adhesive paper based products which are not likely to survive due to fading, or failure of the adhesive, for at least 20 years is not acceptable.

The **Manufacturer** must ensure that the **Interface Protection** is capable of measuring voltage to an accuracy of ± 1.5% of the nominal value (± 3.45V) and of measuring frequency to ± 0.2% of the nominal value (± 0.1Hz) across its operating range of voltage, frequency and temperature.

The **SSEG** shall be designed to withstand without adverse effect, voltage and frequency variations within the settings shown in Table 1 plus the measurement error inherent in the device itself.

In response to a protection operation the **SSEG** system shall be automatically disconnected from the **DNO's Distribution System**, this disconnection must be achieved preferably by the separation of mechanical contacts or alternatively by the operation of a suitably rated solid state switching device. Where a solid state switching device is used to afford disconnection of the **SSEG,** the switching device shall incorporate fail safe monitoring to check the voltage level at its output stage. In the event that the solid state switching device fails to disconnect the **SSEG**, the voltage on the output side of the switching device shall be reduced to a value below 50 volts within 0.5 seconds of the protection and trip delay timer operation.
The protection function can either be incorporated within the **SSEG** system or afforded by separate devices. In either case the **Interface Protection** shall meet the requirements of BS EN 60255 or equivalent standard and comply with all other relevant standards as described in the appropriate annex. Where these standards have more than one part, the requirements of all such parts shall be satisfied, so far as they are applicable.

The **Interface Protection** shall function correctly, ie operate within the required tolerance range as given in the relevant annex, across the expected range of ambient operating temperatures and other environmental factors.

Once the **SSEG** has been installed and commissioned the protection settings shall only be altered following written agreement between the **DNO** and the **Customer** or his agent.

5.3.2 Loss of Mains Protection

Loss of mains protection shall be incorporated and tested as defined in the relevant annex. Active methods which use impedance measuring techniques by drawing current pulses from or injecting **AC** currents into the **DNO's** system are not considered to be suitable. For **SSEGs** which generate on more than one phase, the loss of mains protection should be able to detect the loss of a single phase of the supply network. This should be tested during type testing

and recorded on in Appendix 4.

5.3.3 Frequency Drift and Step Change Stability Test

Under normal operation of the network the frequency changes over time due to continuous unbalance of load and generation or can see a step change due to the loss of a network component which does not cause a loss of supply.

In order to ensure that the phenomena do not cause un-necessary tripping of **SSEG**, stability **Type Tests** shall be carried out.

The Rate of Change of Frequency (RoCoF) and Vector Shift values required for this test are marginally less than the corresponding protection settings for RoCoF protection in Table 1 and vector shifts of up to 50º. Both stability tests shall be carried out in all cases.

The stability tests are to be carried out as per the table in Appendix 4 of this document and the generator should remain connected during each and every test.

- RoCoF - 0.95 Hz per second in the range 49.0Hz to 51.0Hz on both rising and falling frequency
- Vector shift - 50º plus from 49.5Hz and 50º minus from 50.5Hz

5.3.4 Automatic Reconnection

Some **Distribution Systems** employ automatic **Circuit Breakers** that trip and re-close when a fault is detected. In order to prevent a **SSEG** being damaged by a **DNO Circuit Breaker** automatically closing and consequently energising a **SSEG** when it is out of synchronism with the rest of the system, the protection system shall ensure that the **SSEG** remains disconnected from the **DNO's Distribution System** until the voltage and frequency on the **DNO's Distribution System** have remained within the limits of Table 1 for a minimum of 20 seconds[4].

5.4 Quality of Supply

The connection of the **SSEG** in parallel with a **DNO's Distribution System** shall not impair the quality of supply provided by the **DNO** to the **User** or any other **Customer**. In this respect the **SSEG** shall comply with the requirements of the EMC Directive and in particular the product family emission standards listed in Table 2.

Table 2 Basic Emission Standards

Parameter	SSEG rating	Standard	Class
Harmonics	≤ 16 A	EN 61000-3-2	Class A
Voltage fluctuations and Flicker	≤ 16 A	EN 61000-3-3	d_{max} = 4%

These standards were written on the basis that only a small number of devices would be installed on an **LV** network and / or that the duration of operation would be short and therefore permits a large diversity factor to be used.

[4] Reference in accordance with BS EN 50438 (2007)

SSEGs are likely to be installed in large numbers on **LV** networks and they are likely to operate for long periods with no diversity between them, and adjacent **SSEGs** are likely to be of the same technology. Therefore in order to accommodate a high number of **SSEGs** on a network the following procedures need to be applied when testing for harmonic current emissions and flicker.

5.4.1 Testing for Harmonic emissions.

The test must be carried out with a minimum of 2kW of rated **SSEGs**. Where an individual **SSEG** is smaller than 2kW it should be tested as a group. However where a **SSEG** is designed to be installed singly in an installation then this can be tested alone, for example a domestic CHP unit. The maximum group size for the test is 3.68kW.

The results for all **Inverters** should be normalised to a rating of 3.68kW. The **SSEG** or group shall meet the harmonic emissions of table 1 in BS EN 61000-3-2 with a scaling factor applied as follows for each harmonic current;

Table 1 current limit **×** rating of **SSEG** being tested (kW) per phase / 3.68

5.4.2 Testing for flicker

The test must be carried out with a minimum of 2kW of rated **SSEGs**. Where an individual **SSEG** is smaller than 2kW it should be tested as a group. However where a **SSEG** is designed to be installed singly in an installation then this can be tested alone, for example a domestic CHP unit. The maximum group size for the test is 3.68kW.

The **SSEG** or group shall meet the required d_{max}, d_c, $d_{(t)}$, P_{st}, P_{lt} requirements of BS EN 61000-3-3 with a scaling factor applied as follows for each voltage change component.

d_{max}, d_c, $d_{(t)}$, P_{st}, P_{lt} **×** rating of **SSEG** being tested (kW) per phase / 3.68

The results for groups of **Inverters** should be normalised to a rating of 3.68kW and to the standard source impedance. Single **Inverters** need to be normalised to the standard source impedance, these normalised results need to comply with the limits set out in Appendix 4.

For voltage change and flicker measurements the following simplified formula is to be used to convert the measured values to the normalised values where the power factor of the generation output is 0.98 or above. Where it is less than 0.98 then compliance with the full requirements of BS EN 61000-3-3 is required.

Normalised value = Measured value × reference source resistance/measured source resistance at test point.

And for units which are tested as a group.
Normalised value = Measured value × reference source resistance/measured source resistance at test point × 3.68/rating per phase.

Single phase units reference source resistance is 0.4 ohms
Two phase units in a three phase system reference source resistance is 0.4 ohms
Two phase units in a split phase system reference source resistance is 0.24 ohms
Three phase units reference source resistance is 0.24 ohms.
The stopping test should be a trip from full load generation.

The duration of these tests need to comply with the particular requirements set out in the testing notes for the technology under test and can be found in annex C.

The dates and location of the tests need to be noted in Appendix 4

Note: For wind turbines, flicker testing should be carried out during the performance tests specified in IEC 61400-12-1. Flicker data should be recorded from wind speeds of 1m/s below cut-in to 1.5 times 85% of the rated power. The wind speed range should be divided into contiguous bins of 1m/s centred on multiples of 1m/s. The dataset shall be considered complete when each bin includes a minimum of 10 minutes of sampled data. The highest value of each parameter measured across the entire range of tests shall be recorded.

Note that as an alternative to **Type Testing** the supplier of a **SSEG** incorporating an **Inverter** may give a guarantee that rates of change of output do not exceed the following ramp rate limits.
Output needs to ramp up at a constant rate
This exception to site testing does not apply to devices where the output changes in steps of over 30ms rather than as a ramp function, a site test is required for these units.

Single phase units and two phase units in a three phase system, maximum ramp up rate 333 watts per second;
Two phase units in a split phase system and three phase units, maximum ramp up rate 860 watts per second.

It should be noted that units complying with this declaration are likely to be less efficient at capturing energy during times when the energy source is changing.

For technologies other than wind turbines, testing should ensure that the controls or automatic programs used produce the most unfavourable sequence of voltage changes.

5.5 DC Injection

The effects of, and therefore limits for, **DC** currents injected in the **DNO's Distribution System** is an area under current investigation by **DNOs.** Until these investigations are concluded the upper limit for **DC** injection is 0.25% of **AC** current rating per phase. Where a **SSEG** is designed to be installed singly in an installation, for example a domestic CHP unit, then this **DC** injection limit can be a maximum value of 20mA for sub 2kW **SSEG** and can be tested alone,. Where **SSEGs** are designed such that multiple units may be installed in an installation for example roof mounted wind turbines and PV with micro **Inverters** on each panel, then they should be tested as a group of at least 2kW and with a maximum group size of 4kW. Tests are to be carried out a three power levels plus or minus 5%.

At 230V a 2kW single phase **Inverter** has a current output of 8.7A so **DC** limit is 21.75mA; a 10kW three phase **Inverter** has a current output of 14.5A per phase which is equivalent to a total of 43.5A at 230V so **DC** limit is 108.75mA.

Where necessary the **DC** emission requirements can also be satisfied by installing an isolating transformer between the **Inverter** and the connection to the **DNO's Distribution System**.

5.6 Power Factor

When operating at rated power the **SSEG** shall operate at a power factor within the range 0.95 lagging to 0.95 leading relative to the voltage waveform unless otherwise agreed with the **DNO** eg for power factor improvement.

5.7 Short Circuit Current Contribution

5.7.1 Directly Coupled Generation

The **Manufacturer** shall establish the maximum short circuit current contribution from the **SSEG** and the conditions under which this exists. This information shall be provided to the **DNO** by the **Installer** as part of the commissioning notification as per Appendix 3.
One method for determining the short circuit current contribution is described below.

The short circuit current contribution of the **SSEG** shall be measured upon application of a short circuit on the **SSEG** terminals (all phases / phase to neutral) with the **SSEG** operating at rated output steady state conditions.
Current measurements shall be taken from application of fault until the time the fault has been disconnected, following operation of the **SSEG** protection. A current decay plot shall be produced for each phase from inception of the fault until **SSEG** has been disconnected – trip time. The plot will need to show the highest value of peak short circuit current, eg for a **SSEG** supplying a purely inductive load the highest value of peak short circuit current will result when the fault is applied at a voltage zero. Where practicable the tests will need to determine values for all of the relevant parameters listed in Table 3.

These parameters are described in IEC 60909-1, whilst this standard is primarily for three-phase generators the methodology for determining these parameters can be applied to single-phase generators.

Table 3. SSEG Short Circuit Parameters

Parameter	Symbol	Method of Determination
Peak short-circuit current	ip	Direct measurement
Initial value of aperiodic component	A	Direct measurement
Initial symmetrical short-circuit current	Ik”	Interpolation of plot
Decaying (aperiodic) component of short- circuit current	idc	Interpolation of plot & calculation
Reactance / Resistance ratio of source	X/R	Calculation

5.7.2 Inverter Connected Generation

Inverter connected **SSEGs** generally have small short circuit fault contributions.

However **DNOs** need to understand the contribution that they do make to system fault levels in order to determine that they can continue to safely operate without exceeding design fault levels for switchgear and other circuit components.

As the output from an **Inverter** reduces to zero when a short circuit is applied to its terminals, a short circuit test does not represent the worst case scenario; in most cases the voltage will not collapse to zero for a network fault.

A test which ensures that at least 10% of nominal voltage remains and which allows the **SSEG** to feed into a load with an X to R ratio of 2.5 is specified as details in Annex A4.6 for common **Inverter** requirements.

5.8 Voltage Unbalance

There is no requirement to balance phases on installations below or equal to 16A per phase.

For multiple installations of **SSEGs** (eg in new housing developments), balancing the **SSEGs** evenly against the load on the three phases will need to be considered by the **DNO.**

5.9 Certification Requirements

5.9.1 General

Type Tested certification is the responsibility of the **SSEG Manufacturer**. The requirements are detailed in Appendix 4.

5.9.2 Compliance

The **SSEG** shall comply with all relevant European Directives and should be labelled with a CE marking.

5.9.3 Verification Test Report

The **Manufacturer** shall make available upon request a verification test report confirming that the **SSEG** has been **Type Tested** to satisfy the requirements of this Engineering Recommendation. The report shall detail the type and model of **SSEG** tested, the test conditions and results recorded. All of these details shall be included on a test sheet. The required test sheet and declaration is shown in Appendix 4.

6 Operation and Safety

6.1 Operational Requirements

In all cases the **User** shall ensure that the **SSEG** system is so installed, designed and operated to maintain at all times, compliance with the requirements of ESQCR 22(1) (a).

6.2 Labelling

The **Installer** shall provide labelling at the **Exit Point** (Fused Cut Out), meter position, consumer

unit and at all points of isolation between the **Exit Point** and the **SSEG** within the **User's** premises to indicate the presence of a **SSEG**. The labelling should be sufficiently robust and if necessary fixed in place to ensure that it remains legible and secure for the lifetime of the installation. The following sign shall be used.

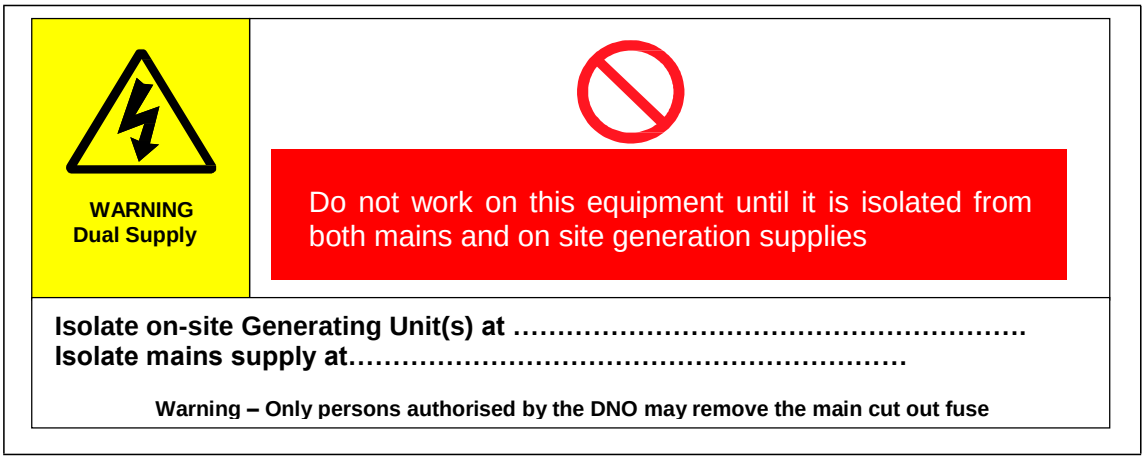


Figure 1 Warning Label

Note: The safety sign does not imply a right on the **Customer, User**, **Installer** or maintainer to operate (remove / replace) the **DNO's** cut-out fuse.

In addition to the safety labelling, this Engineering Recommendation requires the following, up to date, information to be displayed at the point of interconnection with the **DNO's Distribution System.**

a) A circuit diagram relevant to the installation showing the circuit wiring, including all protective devices, between the **SSEG** and the **DNOs** fused cut-out. This diagram should also show by whom all apparatus is owned and maintained;

b) A summary of the protection settings incorporated within the equipment.

Figure 2 shows an outline example of the type of circuit diagram that will need to be displayed. Figure 2 is non-prescriptive and is for illustrative purposes only.

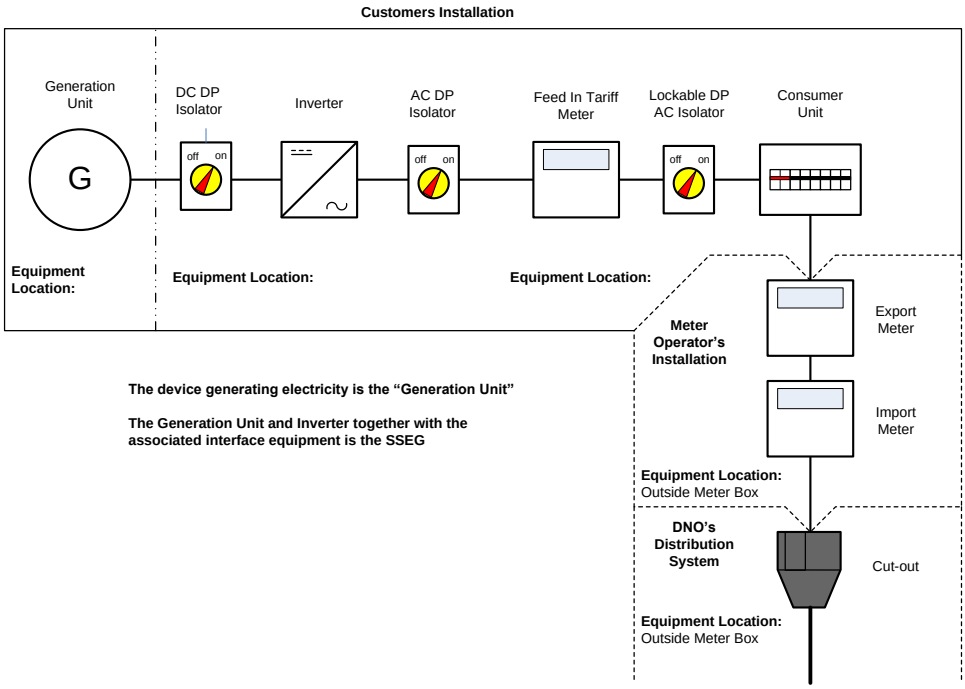


Figure 2 - Example of the type of circuit diagram

The **Installer** shall advise the **User** that it is the **User's** responsibility to ensure that this safety information is kept up to date. The installation operating instructions shall contain the **Manufacturer's** contact details eg name, telephone number and web address.

6.3 Maintenance & Routine Testing

Periodic testing of the **SSEG** is recommended at intervals prescribed by the **Manufacturer**. This information shall be included in the installation and **User** Instructions. The method of testing and/or servicing should be included in the servicing instructions.

6.4 Earthing

When a **SSEG** is operating in parallel with a **DNO's Distribution System** there shall be no direct connection between the **SSEG** current carrying conductors and earth with the following exception;

For a **SSEG** which is designed to operate in parallel with a **DNO's Distribution System** but which is connected via an **Inverter** (eg a PV array or fuel cell) it is permissible to connect one pole of the **DC** side of the **Inverter** to the **DNO's** earth terminal if the insulation between the **AC** and the **DC** sides of the **Inverter** meets the requirements for at least simple separation. The requirements for simple separation are those given in Section 5.3.3 of BS EN 60664-1 for basic insulation. In such cases the **Installer** and **Manufacturer** shall take all reasonable precautions to ensure that the **SSEG** system will not impair the integrity of the **DNO's Distribution System** and will not suffer unacceptable damage for all credible operating conditions, including faults on the **DNO's Distribution System**. In all cases the level of **DC** injection should not exceed that detailed under clause 5.5.

Earthing of all exposed conductive parts shall comply with the requirements of BS 7671.

7 Commissioning/Decommissioning and Acceptance Testing

7.1 General

The information required by a **DNO** under an Application for Connection is shown in Appendix 2. The information required by a **DNO** to confirm commissioning is shown in Appendix 3.
It is the responsibility of the **Installer** to ensure that the relevant information is forwarded to the local **DNO** in accordance with the requirements of 5.1.1 and/or 5.1.2 as appropriate. The pro forma in Appendices 2 and 3 are designed to:

a) simplify the connection procedure for both **DNO** and **SSEG Installer**;

b) provide the **DNO** with all the information required to assess the potential impact of the **SSEG** connection on the operation of the network;

c) inform the **DNO** that the **SSEG** installation complies with the requirements of this Engineering Recommendation;

d) allow the **DNO** to accurately record the location of all **SSEGs** connected to the network.

Compliance with the requirements detailed in the relevant annex in addition to those cited in sections 5 and 6 will ensure that the **SSEG** is considered to be approved for connection to the **DNO's Distribution System**. It is intended that the **Manufacturers** of **SSEG** systems will use the requirements of this Engineering Recommendation to develop type verification certification for each of their **SSEG** models.

Upon receipt of a multiple premises connection application the **DNO's** response will be in accordance with the electricity generation standards set by the **Authority** for applications for connection to the network.

7.2 Installation and Commissioning

The installation shall be carried out by **Installers** who are competent and have sufficient skills, and training (complete with recognised and approved qualifications relating to the fuels used and general electrical installations) to apply safe methods of work to install a **SSEG** in compliance with this Engineering Recommendation.

Notwithstanding the requirements of this Engineering Recommendation, the installation will be carried out to no lower a standard than that required in the **Manufacturer's** installation instructions.

No parameter relating to the electrical connection and subject to type verification certification will be modified unless previously agreed in writing between the **DNO** and the **Customer** or his agent. **User** access to such parameters shall be prevented.

As part of the on-site commissioning tests the **Installer** shall carry out a functional check of the loss of mains protection, for example by removing the supply to the **SSEG** during operation and checking that the **Interface Protection** operates to disconnect the **SSEG** from the **DNO's Distribution System**. For three phase installations this test can be achieved by opening a three phase **Circuit Breaker** or isolator and confirming that the **SSEG** has shut down. Testing for the loss of a single phase is covered in the type testing of **Inverters** see section 5.3.2

7.3 Notification of Commissioning

In accordance with ESQCR and HSE Certificate of Exemption (2008) (see Appendix 6) the **Installer** shall ensure that the **DNO** is advised of the intention to use the **SSEG** in parallel with the network no later than 28 days (inclusive of the day of commissioning), after commissioning the **SSEG**. Notification that the **SSEG** has been connected / commissioned is achieved by completing a commissioning form as per Appendix 3, which also includes the relevant details on the **SSEG** installation required by the **DNO**

7.4 Notification of Changes

If during the lifetime of the **SSEG** it is necessary to replace a major component of the **SSEG**, it is only necessary to notify the **DNO** if the operating characteristics of the **SSEG** or the **Interface Protection** have been altered when compared against the unit that was originally commissioned.

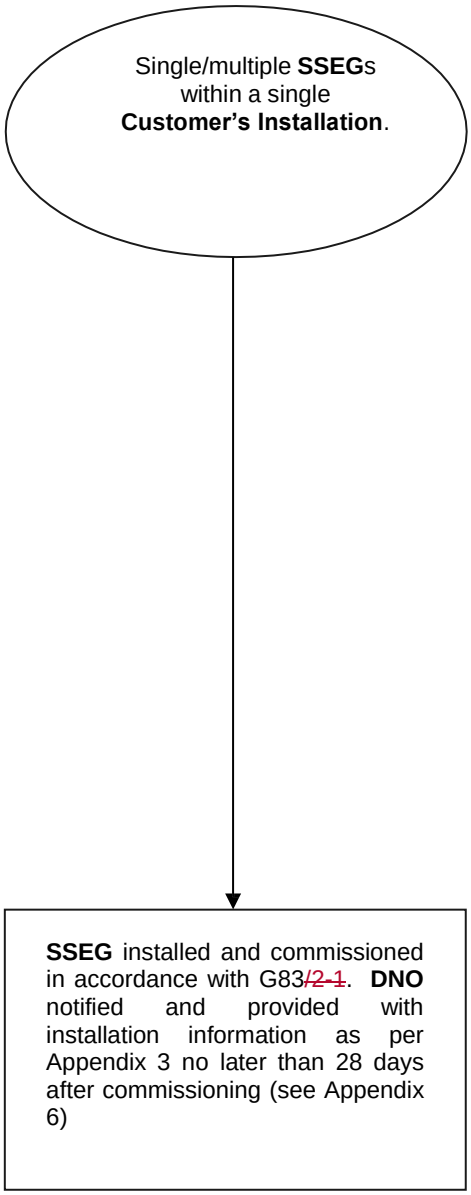
7.5 Notification of Decommissioning

In the event that a **SSEG** system is to be decommissioned and will no longer operate as a source of electrical energy in parallel with the **DNO's Distribution System**, the **User** shall notify the **DNO** by providing the information as detailed under Appendix 5.

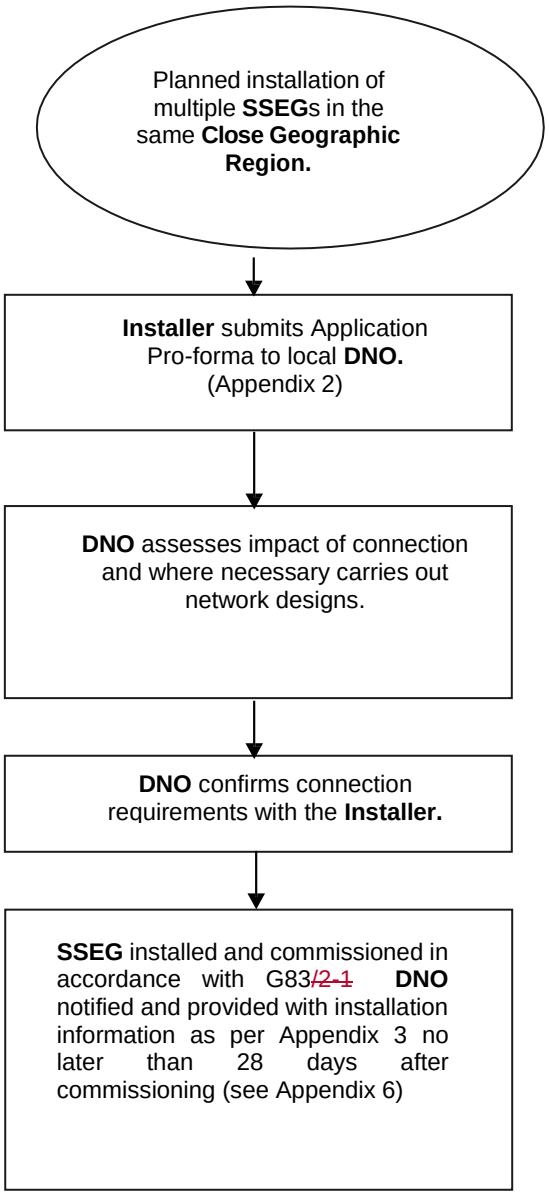
Appendix 1 Connection Procedure Flow Chart - for installations with aggregate capacities of 16A per phase or less and using **Type Tested** equipment. For installations with aggregate capacity in excess of 16A per phase or using non **Type Tested** equipment see the current version of G59.

NOTE: The processes shown here only refer to the interface between the **Installer** and the **DNO**. It may also be necessary for the **Installer** / **User** to inform the relevant **Meter Operator** and **Supplier** that a **SSEG** has been installed.

Connecting SSEG(s) in a single premises



Connecting SSEG(s) in multiple premises



Appendix 2 Application for Connection

SSEG Application for connection of multiple G83/2-~~1~~ 2 installations	
To ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA	DNO or IDNO abced@wxyz.com

Installer Details	
Installer	
Accreditation/Qualification:	
Address	
Post Code	
Contact person	
Telephone Number	
E-mail address	

Proposed SSEG Details.						
Address	Post Code	MPAN	SSEG installed capacity in kW at 230V AC			Type Testing Ref No
			PH1	PH2	PH3	

Use continuation sheet where more than 10 SSEGs are to be installed.
Please include an electronic map with the location of each property highlighted in red.
Record SSEG capacities, in rated output kW at 230V AC, to one decimal place, under PH1 for single phase supplies and under the relevant phase for two and three phase supplies. For example 2.8kW
Detail on a separate sheet if there are any proposals to limit export to a lower figure than that of the SSEG.

Appendix 3 SSEG Installation Commissioning Confirmation

G83/2-~~1~~ 2 SSEG INSTALLATION COMMISSIONING CONFIRMATION In accordance with ESQCR and HSE Certificate of Exemption (2008) (see Appendix 6) the Installer is required to advise the DNO of the intention to use the SSEG in parallel with the network no later than 28 days (inclusive of the day of commissioning), after commissioning the SSEG					
To ABC electricity distribution DNO or IDNO 99 West St, Imaginary Town, ZZ99 9AA abced@wxyz.com					
SSEG installation address details					
Name of Customer at Site					
Customer contact telephone					
Site address					
Post Code					
MPAN					
SSEG owner if different from above					
Name and Contact Address Including Post Code					
Contact telephone number					
SSEG Details					
Note only technologies with Type Tested equipment can be installed under G83.					
Capacities	phase 1 in kW	phase 2 in kW	phase 3 in kW	Type test ref only for new installations	Primary energy source. please enter code from table below~~Eg Wind, Solar PV, Hydro, Gas CHP~~.
New/Existing					
New/Existing					
New/Existing					
New/Existing					
The Maximum aggregate capacity of SSEGs installed in a single customer's installation under G83~~/2-1~~ is 3.68kW per phase at 230V AC. Identify above new SSEG installations and existing installations at the site which have not been de-commissioned as of the date of this declaration. Use a separate line for new and existing installations and for different Primary Energy sources above. For installations above 3.68kW per phase the separate G59 process applies and the DNO needs to be consulted before any installation is undertaken. Use ph 1 column for single phase supply					
I confirm that the new SSEGs noted above has/have been installed and commissioned to comply with the requirements of G83/2-~~1~~ 2 as required by The Distribution Code. I enclose a copy of the circuit diagram which has been left on site at the customers incoming meter location.					
Name		Signed		Date	
On behalf of Installer					
Accreditation / Qualification					
Installer address					
Post code					
Contact person					
Telephone number					
E:mail address					

Primary Energy Source	Code	Primary Energy Source	Code
Solar PV	1	Wind	2
Hydro (run of river)	3	Hydro (reservoir)	4
Biomass	5	Other Renewable	6
Fossil gas	7	Waste	8
Fossil coal gas	9	Fossil oil	10
Fossil oil shale	11	Fossil peat	12
Geothermal	13	Fossil brown coal/lignite	14
Fossil hard coal	15	Hydro pumped storage	16
Marine	17	Nuclear	18
Offshore wind	19	Other	20
Other – battery storage	21	Other – storage - not battery	22

Appendix 4 Type Verification Test Report

Type Approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G83/2-~~1~~2.			
SSEG Type reference number			
SSEG Type			
System Supplier name			
Address			
Tel		Fax	
E:mail		Web site	
Maximum rated capacity, use separate sheet if more than one connection option.	Connection Option		
		kW single phase, single, split or three phase system	
		kW three phase	
		kW two phases in three phase system	
		kW two phases split phase system	
SSEG manufacturer/supplier declaration. I certify on behalf of the company named above as a manufacturer/supplier of Small Scale Embedded Generators, that all products manufactured/supplied by the company with the above SSEG Type reference number will be manufactured and tested to ensure that they perform as stated in this Type Verification Test Report, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of G83/2-~~-1~~2.			
Signed		On behalf of	
Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate. Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.			

Power Quality. Harmonics. The requirement is specified in section 5.4.1, test procedure in Annex A or B 1.4.1						
SSEG rating per phase (rpp)				kW	NV=MV x 3.68/rpp	
Harmonic	At 45-55% of rated output		100% of rated output			
	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2					1.080	
3					2.300	
4					0.430	
5					1.140	
6					0.300	
7					0.770	
8					0.230	
9					0.400	
10					0.184	
11					0.330	
12					0.153	
13					0.210	
14					0.131	
15					0.150	
16					0.115	
17					0.132	
18					0.102	
19					0.118	
20					0.092	

21					0.107	0.160
22					0.084	
23					0.098	0.147
24					0.077	
25					0.090	0.135
26					0.071	
27					0.083	0.124
28					0.066	
29					0.078	0.117
30					0.061	
31					0.073	0.109
32					0.058	
33					0.068	0.102
34					0.054	
35					0.064	0.096
36					0.051	
37					0.061	0.091
38					0.048	
39					0.058	0.087
40					0.046	
Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.						

Power Quality. Voltage fluctuations and Flicker. The requirement is specified in section 5.4.2, test procedure in Annex A or B 1.4.3								
	Starting			Stopping			Running	
	d_{max}	d_c	$d_{(t)}$	d_{max}	d_c	$d_{(t)}$	P_{st}	P_{lt} 2 hours
Measured Values								
Normalised to standard impedance and 3.68kW for multiple units								
Limits set under BS EN 61000-3-2	4%	3.3%	3.3% 500ms	4%	3.3%	3.3% 500ms	1.0	0.65

Test start date		Test end date		
Test location				

Power quality. DC injection. The requirement is specified in section 5.5, test procedure in Annex A or B 1.4.4				
Test power level	10%	55%	100%	
Recorded value				
as % of rated AC current				
Limit	0.25%	0.25%	0.25%	

Power Quality. Power factor. The requirement is specified in section 5.6, test procedure in Annex A or B 1.4.2				
	216.2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1.5% of the stated level during the test.
Measured value				
Limit	>0.95	>0.95	>0.95	

Protection. Frequency tests The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.3						
Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5Hz	20s			47.7Hz 25s	
U/F stage 2	47Hz	0.5s			47.2Hz 19.98s	
					46.8Hz 0.48s	
O/F stage 1	51.5Hz	90s			51.3Hz 95s	
O/F stage 2	52Hz	0.5s			51.8Hz 89.98s	
					52.2Hz 0.48s	

Protection. Voltage tests The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.2						
Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V stage 1	200.1V	2.5s			204.1V 3.5s	
U/V stage 2	184V	0.5s			188V 2.48s	
					180V 0.48s	
O/V stage 1	262.2V	1.0s			258.2V 2.0s	
O/V stage 2	273.7V	0.5s			269.7V 0.98s	
					277.7V 0.48s	
Note for Voltage tests the Voltage required to trip is the setting ±3.45V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Loss of Mains test. The requirement is specified in section 5.3.2, test procedure in Annex A or B 1.3.4						
To be carried out at three output power levels with a tolerance of plus or minus 5% in Test Power levels.						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Limit is 0.5 seconds						
For Multi phase **SSEG**s confirm that the device shuts down correctly after the removal of a single fuse as well as operation of all phases.						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Ph1 fuse removed						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Ph2 fuse removed						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Ph3 fuse removed						
Note for technologies which have a substantial shut down time this can be added to the 0.5 seconds in establishing that the trip occurred in less than 0.5s. Maximum shut down time could therefore be up to 1.0 seconds for these technologies.						
Indicate additional shut down time included in above results.						ms
Note as an alternative, inverters can be tested to BS EN 62116. The following sub set of tests should be recorded in the following table.						
Test Power and imbalance	33% -5% Q Test 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5s						

Protection. Frequency change, Vector Shift Stability test. The requirement is specified in section 5.3.3, test procedure in Annex A or B 1.3.6				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+50 degrees		
Negative Vector Shift	50.5Hz	- 50 degrees		

Protection. Frequency change, RoCoF Stability test. The requirement is specified in section 5.3.3, test procedure in Annex A or B 1.3.6			
Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0Hz to 51.0Hz	+0.95Hzs^{-1}	2.1s	
51.0Hz to 49.0Hz	-0.95Hzs^{-1}	2.1s	

Protection. Re-connection timer. The requirement is specified in section 5.3.4, test procedure in Annex A or B 1.3.5						
Test should prove that the reconnection sequence starts after a minimum delay of 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 1.						
Time delay setting	Measured delay		Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
			At 266.2V	At 196.1V	At 47.4Hz	At 51.6Hz
Confirmation that the SSEG does not re-connect.						

Fault level contribution. The requirement is specified in section 5.7, test procedure in Annex A or B 1.4.6					
For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p		20ms		
Initial Value of aperiodic current	A		100ms		
Initial symmetrical short-circuit current*	I_k		250ms		
Decaying (aperiodic) component of short circuit current*	i_{DC}		500ms		
Reactance/Resistance Ratio of source*	X/R		Time to trip		In seconds

Self-Monitoring solid state switching The requirement is specified in section 5.3.1, No specified test requirements.	Yes/or NA
It has been verified that in the event of the solid state switching device failing to disconnect the SSEG, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 seconds.	

Additional comments

Appendix 5 SSEG Decommissioning Confirmation

G83 SSEG DECOMMISSIONING CONFIRMATION SSEG de-commissioning form and declaration, to be provided to the DNO by the installer no later than 28 days after de-commissioning all, or some of the SSEGs in a Customer's Installation.	
To ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA	DNO or IDNO abced@wxyz.com
Electricity Customer at site	
Customer contact telephone	
SSEG Site address	
Post Code	
MPAN	

SSEG owner if different from above							
Contact Address							
Contact telephone number							
Details of installation							
Removed type		Capacity ph 1 kW		Capacity ph 2 kW		Capacity ph 3 kW	
Remaining type		Capacity ph 1 kW		Capacity ph 2 kW		Capacity ph 3 kW	

I confirm that the SSEG installation noted above has been modified or totally de-commissioned and continues to comply with the requirements of G83~~/2-1~~ as required by the distribution code of Great Britain. I enclose a copy of the system schematic which has been left on site at the customers incoming meter location.					
Name		Signed		Date	
On behalf of Installer					
Accreditation / Qualification					
Installer address					
Post code					
Contact person					
Telephone number					
E:mail address					

Appendix 6 Relaxation of Commissioning Notification Timescales for SSEG: HSE Certificate of Exemption (August 2008)

Electricity Act 1989

Health & Safety At Work Etc Act 1974

The Electricity Safety Quality and Continuity Regulations 2002

Certificate of Exemption

1. The Health and Safety Executive, in pursuance of the powers conferred on it by section 33 of the Electricity Safety Quality and Continuity Regulations 2002 (the "Regulations") Health & Safety At Work Etc Act 1974 (as amended by the Legislative Reform (Health and Safety Executive) Order 2008) and by the Agreement dated 2 October 2006 between the Secretary of State for Trade and Industry and the Health and Safety Commission, and being satisfied as required by regulation 33(2) hereby grants an exemption to the person or persons installing the source of energy from the requirements imposed by regulation 22(2)(c) of the regulations subject to the condition set out in paragraph 2 of this certificate.

2. The condition referred to in paragraph 1 of this certificate is that in so far as Regulation 22(2)(c) of the regulations applies to a source of energy, the person or persons installing the source of energy will ensure that the distributor is advised of the intention to use the source of energy in parallel with network no later than 28 days (inclusive of the day of commissioning) after commissioning the source.

This certificate shall come into force on 4 August 2008 and will remain in force until revoked by the Health and Safety Executive by a certificate in writing.

Annex A-C Guidance on Type Testing Requirements

Annex A Common Inverter Requirements.

Annex B Common Directly Coupled Requirements.

Annex C Separate Specific Technology Requirements.

- C1. Domestic CHP
- C2. Photo-voltaic
- C3. Fuel Cells
- C4. Hydro
- C5. Wind
- C6. Energy Storage Devices

An **SSEG** requiring type testing must be **Type Tested** in relation to its grid connection type and its energy source technology.

Annex A relates to any **SSEG** that uses an **Inverter** (or **Converter**) as its means of connecting to the grid.

Annex B relates to any **SSEG** that during normal running operation is connected directly to the grid.

When type testing any **SSEG** you must select either Annex A **or** Annex B as is most appropriate to the grid connect method relating to the **SSEG** under test.
The **SSEG** may also require additional technology specific type tests as identified in Annex C, this annex relates to the Technology relating to the energy source.

Examples

A Wind Turbine system using an **Inverter** (or **Inverters**) for connection is required to type test using Annex A – "Common **Inverter** Requirements" and Annex C5 – "Wind" Separate Specific Technology Requirements".

A Hydro system using an induction motor connected directly to the grid is required to be **Type Tested** using Annex B – "Directly Coupled Requirements" and Annex C4– "Hydro" of Annex C - "Separate Specific Technology Requirements".

Annex A1 Common Inverter Connected SSEG Requirements

A1.1 Certification & Type Testing SSEG Requirements

This Annex describes a methodology for obtaining type certification or type verification for the interface equipment between the **Inverter** connected **SSEG** and the distribution network. Typically, all interface functions are contained within the **Inverter** and in such cases it is only necessary to have the **Inverter Type Tested.** Alternatively, a package of specific separate parts of equivalent function may also be **Type Tested**.

Other Annexes containing **Inverter** connected equipment may make reference to the requirements specified in this Annex.

This Annex applies for **SSEG** systems either with or without load management or energy storage systems which connected on the generator side of the **Inverter**.

A1.2 CE Marking and Certification

The type verification procedure requires that the **SSEG** interface be certified to the relevant requirements of the applicable Directives before the unit can be labelled with a CE mark. Where the protection control is to be provided as a separate device, this must also be **Type Tested** and certified to the relevant requirements of the applicable Directives before it can be labelled with a CE mark.

Currently there are no harmonised functional standards that apply to the **SSEG Interface Protection**, therefore the **Inverter** and any separate **Interface Protection** unit will require functional **Type Tested** as described in this Annex, and recorded in format similar to that shown in Appendix 4.

A1.3 Type Verification Functional Testing of the Interface Protection

Type Testing is the responsibility of the **Manufacturer**. This test will verify that the operation of the **SSEG Interface Protection** shall result:

a) in the safe disconnection of the **SSEG** from the **DNO's Distribution System** in the event that the protection settings specified in table 1 are exceeded; and
b) in the **SSEG** remaining connected to the **DNO's Distribution System** while network conditions are:
    a. within the envelope specified by the settings plus and minus the tolerances specified for equipment operation in table 1; and
    b. within the trip delay settings specified in table 1.

The **Type Testing** can be done by the **Manufacturer** of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.

Wherever possible the **Type Testing** of an **Inverter** designed for a particular type of **SSEG** should be proved under normal conditions of operation for that technology (unless otherwise noted).

This will require that the chosen **SSEG Interface Protection** is either already incorporated into the **Inverter** or that the discrete device is connected to the **Inverter** for the loss of mains protection test. Testing the voltage and frequency functions may be carried out on the discrete protection device independently or on the **Inverter** complete.

In either case it will be necessary to verify that a protection operation will disconnect the **SSEG** from the **DNO's Distribution System**.

A1.3.1 Disconnection times

The minimum trip delay settings, for tests in A3.2, A3.3 and A3.4, are presented in table 1.

For tests A3.2, A3.3 and A3.4, reconnection shall be checked as detailed in A3.5 below.

A1.3.2 Over / Under Voltage

The **Inverter** shall be tested by operating the **Inverter** in parallel with a variable **AC** test supply, see figure A2. Correct protection and ride-through operation shall be confirmed during operation of the **Inverter.** The set points for over and under voltage at which the **Inverter** system disconnects from the supply will be established by varying the **AC** supply voltage.

To establish a trip voltage, the test voltage should be applied in steps of ± 0.5% or less, of the nominal voltage for a duration that is longer than the trip time delay, for example 1 second in the case of a delay setting of 0.5 second starting at least 4V below or above the setting. The test voltage at which this trip occurred is to be recorded. Additional tests just above and below the trip voltage should be undertaken to show that the test is repeatable and the figure at which a repeatable trip occurs should be recorded on the type verification test report Appendix 4 of this Engineering Recommendation.

To establish the trip time, the test voltage should be applied starting from 4V below or above the recorded trip voltage and should be changed to 4V above or below the recorded trip voltage in a single step. The time taken from the step change to the **SSEG** tripping is to be recorded on on the type verification test report Appendix 4 of this Engineering Recommendation.

To establish correct ride-through operation, the test voltage should be applied at each setting plus or minus 4V and for the relevant times shown in the table in Appendix 4.

For example to test overvoltage setting stage 1 which is required to be set at nominally 262.2**V** the circuit should be set up as shown below and the voltage adjusted to 254.2 volts. The **Inverter** should then be powered up to export a measureable amount of energy so that it can be confirmed that the **Inverter** has ceased to output energy. The variable voltage supply is then increased in steps of no more than 0.5% of nominal (1.15V) maintaining the voltage for at least 1.5 seconds (trip time plus 0.5 seconds) at each voltage level. At each voltage level confirmation that the **Inverter** has not tripped after the time delay is required to be taken. At the voltage level at which a trip occurs then this should be recorded as the provisional trip voltage. Additional tests just below and if necessary just above the provisional trip voltage will allow the actual trip voltage to be established on a repeatable basis. This value should be recorded. For the sake of this example the actual trip level is assumed to have been established as being 261V. The variable voltage supply should be set to 257V the **Inverter** set to produce a measureable output and then the voltage raised to 265V in a single step. The time from the step change to the output of **Inverter** falling to zero should be recorded as the trip time.

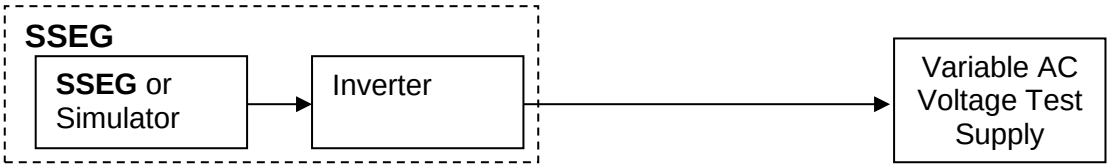
The **Inverter** then needs to operate at 4 volts below the nominal overvoltage stage 1 setting which is 258.2V for a period of at least 2 seconds without tripping and while producing a measurable output. This can be confirmed as a no trip in the relevant part of Appendix 4. The voltage then needs to be stepped up to the next level of 269.7V for a period of 0.98 seconds and then back to 258.2V during which time the output of the relay should continue with no interruption though it may change due to the change in voltage, this can be recorded as a no trip for the second value. The step up and step down test needs to be done a second time with

a max value of 277.7V and with a time of 0.48 seconds. The **Inverter** is allowed to shut down during this period to protect its self as allowed by note 2 of Table 1 of this document, but it must resume production again when the voltage has been restored to 258.2V or it may continue to produce an output during this period. There is no defined time for resumption of production but it must be shown that restart timer has not operated so it must begin producing again in less than 20 seconds.

Note that this philosophy should be applied to the under voltage, over and under frequency, RoCoF and Vector shift stability tests which follow.

Note:
(1) The frequency required to trip is the setting plus or minus 0.1Hz
(2) Measurement of operating time should be measured at a value of 0.2Hz (suggestion – 2 x tolerance) above/below the setting to give "positive" operation
(3) The "No trip tests" need to be carried out at the relevant values and times as shown in the table above to ensure that the protection will not trip in error.

Figure A2. SSEG Test set up – Over / Under Voltage



A1.3.3 Over / Under Frequency

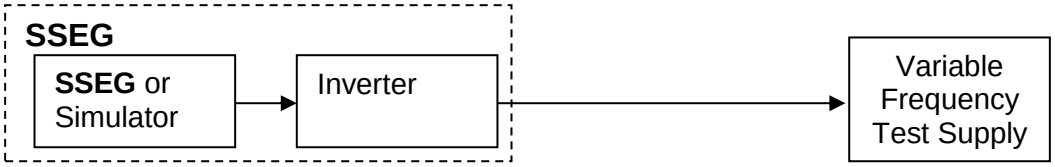
The **Inverter** shall be tested by operating the **Inverter** in parallel with a low impedance, variable frequency test supply system, see figure A3. Correct protection and ride-through operation should be confirmed during operation of the **Inverter**. The set points for over and under frequency at which the **Inverter** system disconnects from the supply will be established by varying the test supply frequency.

To establish a trip frequency, the test frequency should be applied in a slow ramp rate of less than 0.1Hz/second, or if this is not possible in steps of 0.05Hz for a duration that is longer than the trip time delay, for example 1 second in the case of a delay setting of 0.5 second. The test frequency at which this trip occurred is to be recorded. Additional tests just above and below the trip frequency should be undertaken to show that the test is repeatable and the figure at which a repeatable trip occurs should be recorded on the type verification test report Appendix 4 of this Engineering Recommendation.

To establish the trip time, the test frequency should be applied starting from 0.3Hz below or above the recorded trip frequency and should be changed to 0.3Hz above or below the recorded trip frequency in a single step. The time taken from the step change to the **SSEG** tripping is to be recorded on the type verification test report Appendix 4 of this Engineering Recommendation. It should be noted that with some loss of mains detection techniques this test may result in a faster trip due to operation of the loss of mains protection. There are two ways around this. Firstly the loss of mains protection may be able to be turned off in order to carry out this test. Secondly by establishing an accurate frequency for the trip a much smaller step change could be used to initiate the trip and establish a trip time. This may require the test to be repeated several times to establish that the time delay is correct.

To establish correct ride-through operation, the test frequency should be applied at each setting plus or minus 0.2Hz and for the relevant times shown in the table in Appendix 4.

Figure A3 SSEG Test set up – Over / Under Frequency



A1.3.4 Loss of Mains Protection

The tests should be carried out in accordance with BS EN 62116 and a subset of results should be recorded as indicated in the Protection – Loss of Mains test section of Annex 4 Type Test Verification Report.

A1.3.5 Re-connection

Further tests will be carried out with the three test circuits above to check the **Inverter** time out feature prior to automatic network reconnection. This test will confirm that once the **AC** supply voltage and frequency have returned to be within the stage 1 settings specified in table 1 following an automatic protection trip operation there is a minimum time delay of 20 seconds before the **Inverter** output is restored (ie before the **Inverter** automatically reconnects to the network).

A1.3.6 Frequency Drift and Step Change Stability test.

The tests will be carried out using the same circuit as specified in A1.3.3 above and following confirmation that the **SSEG** has passed the under and over frequency trip tests and the under and over frequency stability tests.

Four tests are required to be carried out with all protection functions enabled including loss of mains. For each stability test the **SSEG** should not trip during the test.

For the step change test the **SSEG** should be operated with a measurable output at the start frequency and then a vector shift should be applied by extending or reducing the time of a single cycle with subsequent cycles returning to the start frequency. The start frequency should then be maintained for a period of at least 10 seconds to complete the test. The **SSEG** should not trip during this test.

For frequency drift tests the **SSEG** should be operated with a measurable output at the start frequency and then the frequency changed in a ramp function at 0.95Hz per second to the end frequency. On reaching the end frequency it should be maintained for a period of at least 10 seconds. The **SSEG** should not trip during this test.

A1.4 POWER QUALITY

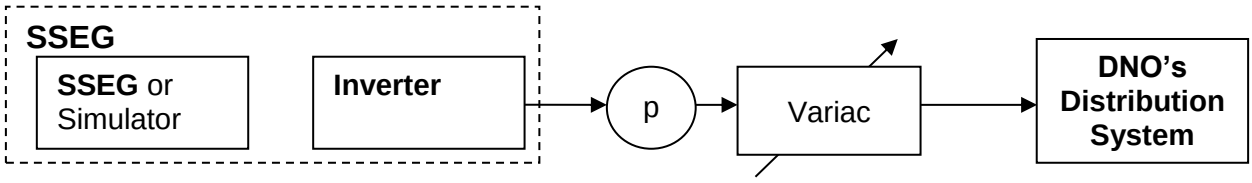
A1.4.1 Harmonics

The tests should be carried out as specified in BS EN 61000-3-2 and can be undertaken with a fixed source of energy at two power levels firstly between 45 and 55% and at 100% of maximum export capacity.

A1.4.2 Power Factor

The test set up shall be such that the **Inverter** supplies full load to the **DNO's Distribution System** via the power factor (pf) meter and the variac as shown below in figure A5. The **Inverter** pf should be within the limits given in 5.6, for three test voltages 230 V –6%, 230V and 230 V +10%.

Figure A5 SSEG Test set up – Power Factor



NOTE 1 For reasons of clarity the points of isolation are not shown.
NOTE 2: It is permissible to use a voltage regulator or tapped transformer to perform this test rather than a variac as shown.

A1.4.3 Voltage Flicker

The voltage fluctuations and flicker emissions from the **SSEG** shall be measured in accordance with BS EN 61000-3-3 and technology specific annex.

A1.4.4 DC Injection

The level of **DC** injection from the **Inverter**-connected PV generator in to the **DNO's Distribution System** shall not exceed the levels specified in 5.5 when measured during operation at three levels, 10%, 55% and 100% of rating with a tolerance of plus or minus 5%.

The DC injection requirements can be satisfied by the installation of an isolation transformer on the **AC** side of an **Inverter**-connected **SSEG**. A declaration that an isolating transformer is fitted can be made in lieu of the tests noted above.

A1.4.5 Overcurrent Protection

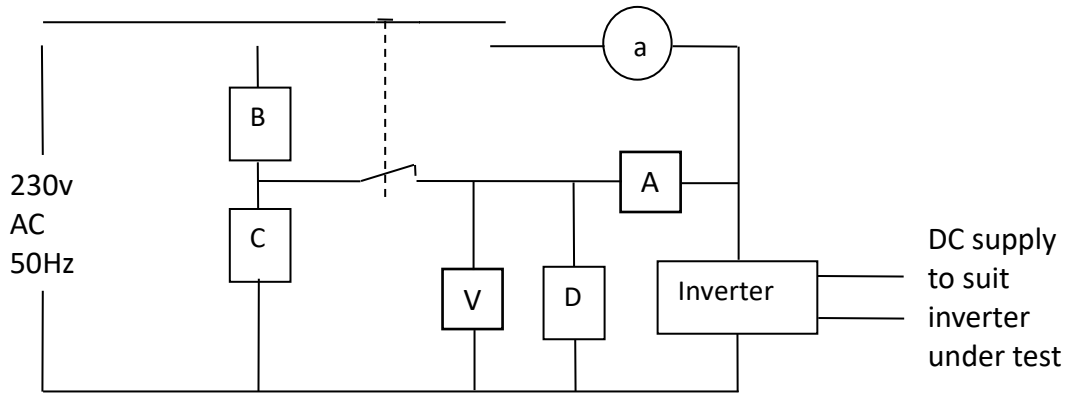
Where appropriate the protection shall comply with the requirements of BS7671.

A1.4.6 Short Circuit Current Contribution

Inverter connected **SSEG**'s generally have small short circuit fault contributions however **DNO**'s need to understand the contribution that they do make to system fault levels in order to determine that they can continue to safely operate without exceeding design fault levels for switchgear and other circuit components.

The following type tests shall be carried out and the results noted in Appendix 4.

Test circuit



Test procedure

'A' and 'V' are ammeters and voltmeters used to record the test data required. Component 'D' is a resistive load plus resonant circuit as required for the loss of mains test as specified in BS EN 62116 set up to absorb 100% rated output of the **Inverter**. Component 'a' is an ammeter used to confirm that all the output from the **Inverter** is being absorbed by component D. Components 'B' and 'C' are set up to provide a voltage of between 10% and 40% of nominal when component 'C' carries the rated output of the **Inverter** in Amps.
Component 'C' should be short term rated to carry the load which would appear through it should it be energised at 253V for at least 1s. Component 'B' is to have an impedance of between 10 and 20 ohms per phase. If components 'B' and 'C' are short time rated than an additional switch in series with 'B' and 'C' can be inserted and arranged to be closed shortly before the main change over switch shown on the drawing and opened at the end of the test period. Components 'B' and 'C' are to have an X to R ratio of 2.5 to 1.

The test is carried out by setting up the **Inverter** and load 'D' to produce and then absorb full rated output of the **Inverter**. When zero export is shown by ammeter 'a' then the changeover switch shown is operated connecting the **Inverter** to the reduced voltage connection created by components 'B' and 'C' and disconnecting if from the normal connection. The make contact is an early make and the break contact a late break so that the inverter is not disconnected from a mains connection for any significant time.

The values of voltage and current should be recorded for a period of up to 1 second when the changeover switch should be returned to the normal position. The voltage and current at relevant times shall be recorded in the type test report (Appendix 4) including the time taken for the **Inverter** to trip. (It is expected that the **Inverter** will trip on either loss of mains or under voltage in less than one second).

A1.4.7 Self-Monitoring - Solid State Disconnection

Some **Inverter**s include solid state switching devices to disconnect from the **DNO's Distribution System**. In this case 5.3.1 requires the control equipment to monitor the output stage of the **Inverter** to ensure that in the event of a protection initiated trip the output voltage is either disconnected completely or reduced to a value below 50 volts **AC**. This shall be

verified either by self-certification by the **Manufacturer**, or additional material shall be presented to the tester sufficient to allow an assessment to be made.

A1.4.8 Electromagnetic Compatibility (EMC)

All equipment shall comply with the generic EMC standards: BS EN61000-6-3: 2007 Electromagnetic Compatibility, Generic Emission Standard; and BS EN61000-6-1: 2007 Electromagnetic Compatibility, Generic Immunity Standard.

Annex B1 Common Directly Coupled Connected SSEG Requirements

B1.1 Certification & Type Testing General Requirements

This Annex describes a methodology for obtaining type certification or type verification for the interface equipment between a directly coupled SSEG and the distribution network. Interface functions can be provided by either as an integrated part of the controller or by incorporating a **Type Tested** protection relay.

Other Annexes containing directly coupled equipment may make reference to the requirements specified in this Annex.

This Annex applies for **SSEG** systems either with or without load management or energy storage systems which connected on the generator side of the controller.

B1.2 CE Marking & Certification

The type verification procedure requires that the **SSEG** interface be certified to the relevant requirements of the applicable Directives before the unit can be labelled with a CE mark. Where the protection control is to be provided as a separate device, this must also be **Type Tested** and certified to the relevant requirements of the applicable Directives before it can be labelled with a CE mark.

Currently there are no harmonised functional standards that apply to the **SSEG Interface Protection**, therefore the **Controller** and any separate **Interface Protection** unit will require the functionality to be **Type Tested** as described in this Annex, and recorded in format similar to that shown in Appendix 4.

B1.3 Type Verification Functional Testing of the Interface Protection

Type verification testing is the responsibility of the **Manufacturer**. This test will verify that the operation of the **SSEG Interface Protection** shall result:

a) in the safe disconnection of the **SSEG** from the **DNO's Distribution System** in the event that the protection settings specified in table 1 are exceeded; and
b) in the **SSEG** remaining connected to the **DNO's Distribution System** while network conditions are:
   a. within the envelope specified by the settings plus and minus the tolerances specified for equipment operation in table 1; and
   b. within the trip delay settings specified in table 1.

The testing can be done by the **Manufacturer** of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.

Wherever possible the type verification testing of the **SSEG** control system should be proved under normal conditions of operation for that technology (unless otherwise noted).

This will require that the chosen **SSEG Interface Protection** is either already incorporated into the **Controller** or that the discrete device is connected to the **Controller** for the loss of mains protection test. Testing the voltage and frequency functions may be carried out on the discrete protection device independently or as part of the **Controller**.
In either case it will be necessary to verify that a protection operation will disconnect the **SSEG** from the **DNO's Distribution System**
The **Manufacturer** must declare the ambient operating temperature range of the **SSEG**, and

verify that the **Interface Protection** will operate satisfactorily throughout this temperature range.

B1.3.1 Disconnection times

The minimum trip delay settings, for tests in B3.2, B3.3 and B3.4, are presented in table 1.

For tests B3.2, B3.3 and B3.4, reconnection shall be checked as detailed in 5.3.4 as a mechanical based system.

In some systems it may be safer and more convenient to test the trip delay time and the disconnection time separately. This will allow the trip delay time to be measured in a test environment (in a similar way as you could test a protection relay). The disconnection time can be measured in the **SSEG's** normal operation, allowing accurate measurement with correct inertia and prime mover characteristics. This is permitted providing the total disconnection time does not exceed the value specified in section 5.3.1. When measuring the shutdown time, 5 shutdowns should be initiated, and the average time recorded.

B1.3.2 Over / Under Voltage

The **Controller** shall be tested by operating the **Controller** in parallel with a variable **AC** test supply, see figure B2. Correct protection and ride-through operation shall be confirmed. The set points for over and under voltage at which the **Controller** disconnects from the supply, will be established by varying the **AC** supply voltage. The disconnect sequence should be initiated when the conditions of table 1 are met, otherwise normal operation should continue.

To establish the certified trip voltage, the test voltage should be applied in steps of ± 0.5% of setting for a duration that is longer than the trip time delay, for example 1 second in the case of a delay setting of 0.5 second. It will be necessary to carry out five tests for each trip setting. The test voltage at which this trip occurred is to be recorded as the certified trip voltage.

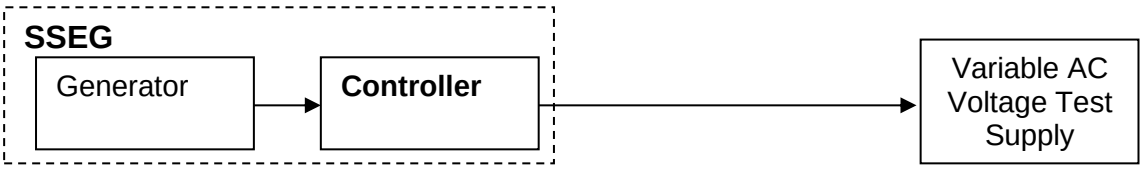
To establish the certified trip time, the test voltage should be applied starting from ± 4V below the certified trip voltage in a step of at least ± 0.5% of setting for a duration that is longer than the trip time delay, for example 1 second in the case of a delay setting of 0.5 second. It will be necessary to carry out five tests for each trip setting. The longest trip time is to be recorded as the certified trip time.

For example to test overvoltage setting stage 1 which is required to be set at nominally 262.2**V** the circuit should be set up as shown below and the voltage adjusted to 254.2 volts. The **Inverter** should then be powered up to export a measurable amount of energy so that it can be confirmed that the **Inverter** has ceased to output energy. The variable voltage supply is then increased in steps of no more than 0.5% of nominal (1.15V) maintaining the voltage for at least 1.5 seconds (trip time plus 0.5 seconds) at each voltage level. At each voltage level confirmation that the **Inverter** has not tripped after the time delay is required to be taken. At the voltage level at which a trip occurs then this should be recorded as the provisional trip voltage. Additional tests just below and if necessary just above the provisional trip voltage will allow the actual trip voltage to be established on a repeatable basis. This value should be recorded. For the sake of this example the actual trip level is assumed to have been established as being 261V. The variable voltage supply should be set to 257V the **Inverter** set to produce a measurable output and then the voltage raised to 265V in a single step. The time from the step change to the output of **Inverter** falling to zero should be recorded as the trip time.

To establish correct ride-through operation, the test voltage should be applied at each setting plus or minus 4V and for the relevant times shown in the table in Appendix 4.

Test results should be recorded on the Test Sheet shown in Appendix 4.

Figure B2.-SSEG Test set up – Over / Under Voltage



B1.3.3 Over / Under Frequency

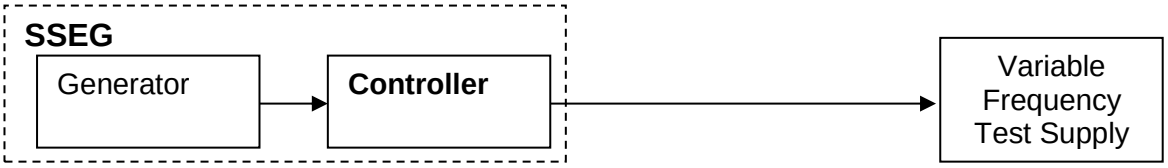
The protection shall be tested by operating the **SSEG** in parallel with a low impedance, variable frequency test supply system, see figure B3. Correct protection and ride-through operation should be confirmed during operation of the **SSEG**. The set points for over and under frequency at which the **SSEG** system disconnects from the supply will be established by varying the test supply frequency.

To establish a trip frequency, the test frequency should be applied in a slow ramp rate of less than 0.1Hz/second, or if this is not possible in steps of 0.05Hz for a duration that is longer than the trip time delay, for example 1 second in the case of a delay setting of 0.5 second. The test frequency at which this trip occurred is to be recorded. Additional tests just above and below the trip frequency should be undertaken to show that the test is repeatable and the figure at which a repeatable trip occurs should be recorded on the type verification test report Appendix 4 of this Engineering Recommendation.

To establish the trip time, the test frequency should be applied starting from 0.3Hz below or above the recorded trip frequency and should be changed to 0.3Hz above or below the recorded trip frequency in a single step. The time taken from the step change to the **SSEG** tripping is to be recorded on the type verification test report Appendix 4 of this Engineering Recommendation. It should be noted that with some loss of mains detection techniques this test may result in a faster trip due to operation of the loss of mains protection. There are two ways around this. Firstly the loss of mains protection may be able to be turned off in order to carry out this test. Secondly by establishing an accurate frequency for the trip a much smaller step change could be used to initiate the trip and establish a trip time. This may require the test to be repeated several times to establish that the time delay is correct.

To establish correct ride-through operation, the test frequency should be applied at each setting plus or minus 0.2Hz and for the relevant times shown in the table in Appendix 4.

Figure B3. SSEG Test set up – Over / Under Frequency

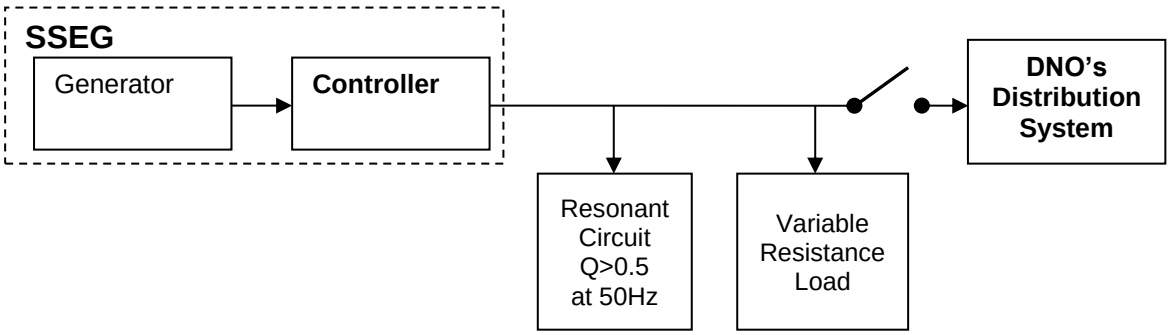


B1.3.4 Loss of Mains Protection

The resonant test circuit specified in this test has been designed to model the interaction of the directly coupled **SSEG** under test with the local load including multiple directly coupled connected **SSEG**s in parallel.

The directly coupled **SSEG** output shall be connected to a network combining a resonant circuit with a Q factor of >0.5 and a variable load. The value of the load is to match the directly coupled **SSEG** output. To facilitate the test for LoM there shall be a switch placed between the test load/directly coupled **SSEG** combination and the **DNO's Distribution System**, as shown below:

Figure B4 SSEG Test set up - Loss of Mains



The directly coupled **SSEG** is to be tested at three levels of the directly coupled **SSEG's** output power: 10%, 55% and 100% and the results recorded on the test sheet of Appendix 4. For each test the load match is to be within ± 5%. Each test is to be repeated five times.

Load match conditions are defined as being when the current from the directly coupled **SSEG** meets the requirements of the test load ie there is no export or import of supply frequency current to or from the **DNO's Distribution System**.

The tests will record the directly coupled **SSEG**'s output voltage and frequency from at least 2 cycles before the switch is opened until the protection system operates and disconnects itself from the **DNO's Distribution System**, or for five seconds whichever is the lower duration.

The time from the switch opening until the protection disconnection occurs is to be measured and must comply with the requirements in table 1.

B1.3.5 Re-connection

Further tests will be carried out with the three test circuits above to check the directly coupled **SSEG** time- out feature prior to automatic network reconnection. This test will confirm that once the **AC** supply voltage and frequency have returned to within the stage 1 settings specified in table 1 following an automatic protection trip operation there is a minimum time delay as specified in table 1 before reconnection will be allowed.

B1.3.6 Frequency Drift and Step Change Stability test.

The tests will be carried out using the same circuit as specified in B1.3.3 above and following confirmation that the **SSEG** has passed the under and over frequency trip tests and the under and over frequency stability tests.

Four tests are required to be carried out with all protection functions enabled including loss of mains. For each stability test the **SSEG** should not trip during the test.

For the step change test the **SSEG** should be operated with a measurable output at the start frequency and then a vector shift should be applied by extending or reducing the time of a single cycle with subsequent cycles returning to the start frequency. The start frequency should then be maintained for a period of at least 10 seconds to complete the test. The **SSEG** should not trip during this test.

For frequency drift tests the **SSEG** should be operated with a measurable output at the start frequency and then the frequency changed in a ramp function at 0.95Hz per second to the end frequency. On reaching the end frequency it should be maintained for a period of at least10 seconds. The **SSEG** should not trip during this test.

B1.4. POWER QUALITY

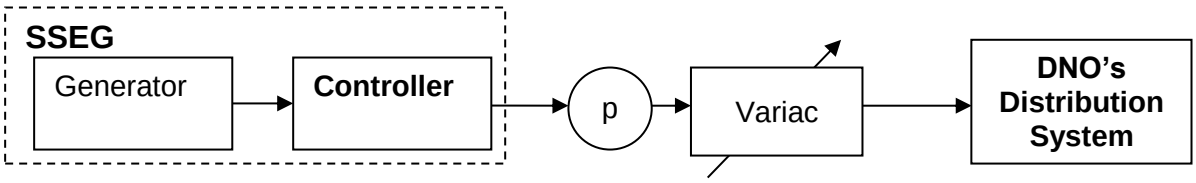
B1.4.1 Harmonics

The tests should be carried out as specified in BS EN 61000-3-2 and can be undertaken with a fixed source of energy at two power levels firstly between 45 and 55% and at 100% of maximum export capacity.

B1.4.2 Power Factor

The test set up shall be such that the directly coupled **SSEG** supplies full load to the **DNO's Distribution System** via the power factor (pf) meter and the variac as shown below in figure B5. The directly coupled **SSEG** pf should be within the limits given in 5.6, for three test voltages 230 V –6%, 230V and 230 V +10%.

Figure B5 SSEG Test set up – Power Factor



NOTE 1. For reasons of clarity the points of isolation are not shown
NOTE 2: It is permissible to use a voltage regulator or tapped transformer to perform this test rather than a variac as shown

B1.4.3 Voltage Flicker

The voltage fluctuations and flicker emissions from the **SSEG** shall be measured in accordance with BS EN 61000-3-3 and technology specific annex.

B1.4.4 DC Injection

The level of **DC** injection from the directly coupled **SSEG** to the **DNO's Distribution System** shall not exceed the levels specified in 5.5. In a directly coupled **SSEG**, any harmonics present will be as a result of any electronic components, with in the **Controller** and can be measured at 0% load.

B1.4.5 Overcurrent Protection

Where appropriate the protection shall comply with the requirements of BS7671.

B1.4.6 Short Circuit Current Contribution

DNOs need to understand the contribution an **SSEG** makes to system fault levels in order to determine that they can continue to safely operate without exceeding design fault levels for switchgear and other circuit components.

For rotating machines BS EN 60034-4:1995 Methods for determining synchronous machine quantities from tests should be used to establish the parameters required to be recorded in Appendix 4 under the section Fault Level Contribution.

For rotating machines and linear piston machines the test should produce a 0 – 2 second plot of the short circuit current as seen at the **SSEG** terminals.

*Values for parameters marked in Annex 4 should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.

B1.4.7 Electromagnetic Compatibility (EMC)

All equipment shall comply with the generic EMC standards: BS EN61000-6-3: 2007 Electromagnetic Compatibility, Generic Emission Standard; and BS EN61000-6-1: 2007 Electromagnetic Compatibility, Generic Immunity Standard.

Annex C1 Separate Specific SSEG Technology Requirements

C1.1 Domestic CHP

For Domestic CHP **SSEGs** connected to the **DNO's Distribution System** via an **Inverter**, the type verification testing and **Interface Protection** requirements will be as per the requirements defined in Annex A.

For Domestic CHP **SSEGs** directly coupled to the **DNO's Distribution System**, the type verification testing and **Interface Protection** requirements will be as per the requirements defined in Annex B.

C1.2 Photovoltaic

As all current Photovoltaic **SSEGs** will connect to the **DNO's Distribution System** via an **Inverter**, the type verification testing and **Interface Protection** requirements will be as per the requirements defined in Annex A.

C1.3 Fuel Cells

As all current Fuel Cell **SSEG**s will connect to the **DNO's Distribution System** via an **Inverter**, the type verification testing and **Interface Protection** requirements will be as per the requirements defined in Annex A.

C1.4 Hydro

Hydro can be connected to the **DNO's Distribution System** directly using induction or synchronous generators or it can be connected by an **Inverter**.

The common requirements for the generator technologies will apply to micro hydro in addition the following needs to be taken into consideration.

SSEGs with manually fixed output or where the output is fixed by controlling the water flow through the turbine to a steady rate, need to comply with the maximum voltage change requirements of BS EN 61000-3-2 but do not need to be tested for P_{st} or P_{lt}.

SSEGs where the output is controlled by varying the load on the generator using the **Inverter** and which therefore produces variable output need to comply with the maximum voltage change requirements of BS EN 61000-3-2 and also need to be tested for P_{st} and P_{lt} over a period where the range of flows varies over the design range of the turbine with a period of at least 2 hours at each step with there being 10 steps from min flow to maximum flow. P_{st} and P_{lt} values to recorded and normalised as per the method laid down in Appendix 4.

C1.5 Wind

Wind turbines can be connected to the **DNO's Distribution System** directly, typically using asynchronous induction generators, or using **Inverter**s.

For those connected via **Inverters**, the type verification testing and interface protection requirements shall be as specified in Annex A.

For those connected directly to the **DNO's Distribution System**, the type verification testing and interface protection requirements shall be as specified in Annex B.

In addition, in either case, the note regarding wind turbine voltage flicker testing specified in 5.4 shall apply**.**

C1.6 Energy Storage Device

Energy Storage Devices can be connected to the **DNO's Distribution System** directly or using **Inverters**.

For those connected via **Inverters**, the type verification testing and interface protection requirements shall be as specified in Annex A.

For those connected directly to the **DNO's Distribution System**, the type verification testing and interface protection requirements shall be as specified in Annex B.

Appendix 4

PRODUCED BY THE OPERATIONS DIRECTORATE OF ENERGY NETWORKS ASSOCIATION

Engineering Recommendation G98

Issue 1 – Amendment ~~2~~3

16 May 2018

Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019

PUBLISHING AND COPYRIGHT INFORMATION

Operations Directorate
Energy Networks Association
4 More London Riverside
LONDON
SE1 2AU

Amendments since publication

Issue	Date	Amendment
G98/1-1	23 July 2018	House keeping modification 1. To implement the Authority's decision on DC0079, ie to disallow the use of VS protection and to provide new RoCoF requirements for type tested generation. Changes to clauses 9.2.1; 10.1.3; 10.3.3; 10.3.4; Form C; A.1.2.6; A.2.2.6. 2. Correction of implementation date to 27 April 2019 throughout. 3. A small number of minor typographical corrections throughout
G98/1-2	10 Dec 2018	Modification to incorporate Integrated Micro Generation and Storage procedure (otherwise known as the energy storage fast track procedure) into EREC G98 and G99. A small number of minor typographical corrections throughout.
G98/1-3	[14 Feb 2019]	Amendments to add new fuel/technology type to Appendix 3

Form B: Installation Document for connection under G98

Please complete and provide this document for each premises, once **Micro-generator** installation is complete.

To ABC electricity distribution **DNO**

99 West St, Imaginary Town, ZZ99 9AA abced@wxyz.com

Customer Details:	
Customer (name)	
Address	
Post Code	
Contact person (if different from **Customer**)	
Telephone number	
E-mail address	
Customer signature	
Installer Details:	
Installer	
Accreditation / Qualification	
Address	
Post Code	
Contact person	
Telephone Number	
E-mail address	
Installer signature	
Installation details	
Address	
Post Code	
MPAN(s)	
Location within **Customer's Installation**	

Location of Lockable Isolation Switch			
Details of Micro-generator			
Manufacturer / Reference			
Date of Installation			
Primary Energy source please enter code from table below			
Power Factor			
Manufacturer's reference number			
Emerging technology classification (if applicable)			
Micro-generator Registered Capacity in kW	3-Phase Units		
	Single Phase Units	PH1	
		PH2	
		PH3	

Declaration – to be completed by Installer for Micro-generators Tested to EREC G98

I declare that the relevant **Micro-generators** and the installation which together form a **Micro-generating Plant** within the scope of EREC G98 at the above address, conform to the requirements of EREC G98. This declaration of compliance is confined to **Micro-generating Plant** tested to EREC G98 or EREC G83 as applicable at the time of commissioning.

Signature:	Date:

Summary details of Micro-generators - where multiple **Micro-generators** will exist within one premises.

Manufacturer	Date of Installation	Technology Type/Primary Energy Source	**Manufacturer's** Ref No (this number should be registered on the ENA **Type Test Verification Report** Register as Product ID)	**Micro-generator Registered Capacity** in kW				
				3-Phase Units	Single Phase Units			Power Factor
					PH1	PH2	PH3	

Use a separate line for new and existing installations and for different Primary Energy sources above. Use PH 1 column for single phase supply.

Primary Energy Source	Code	Primary Energy Source	Code
Solar PV	1	Wind	2
Hydro (run of river)	3	Hydro (reservoir)	4
Biomass	5	Other Renewable	6
Fossil gas	7	Waste	8
Fossil coal gas	9	Fossil oil	10
Fossil oil shale	11	Fossil peat	12
Geothermal	13	Fossil brown coal/lignite	14
Fossil hard coal	15	Hydro pumped storage	16
Marine	17	Nuclear	18
Offshore wind	19	Other	20
Other – battery storage	21	Other – storage - not battery	22